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Proceedings of the Second Annual NASA Science Internet User Working Group Conference

NSI

NASA Science Internet

Proceedings of a conference held in
San Mateo, California
February 11–14, 1991

NASA

NASA Conference Publication 3117

Proceedings of the Second Annual NASA Science Internet User Working Group Conference

Edited by
Lenore A. Jackson
ST Systems Corporation (STX)
Lanham, Maryland

J. Patrick Gary
NASA Goddard Space Flight Center
Greenbelt, Maryland

Proceedings of a conference held in
San Mateo, California
February 11–14, 1991

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Acknowledgements

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Lenore A. Jackson
J. Patrick Gary
Editors

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I. NSIUWG Conference Agenda and List of Attendees

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Agenda

Agenda is subject to change

Monday, February 11th

8:30-12:00	Conference Setup	Cypress
12:00-1:30	Lunch	
1:30-3:00	Registration begins	Cypress
3:00-5:00	Executive Committee Meeting	Boston
5:00-7:00	Cocktails	Eucalyptus
6:00-7:30	Routing Center Managers Meeting	Boston

Tuesday, February 12th

8:30-8:45	Opening Session: *R. Zwickl*	Crystal Springs
Plenary Sessions:		
8:45-9:45	NSI Management Retreat Results *J. Hart*	Crystal Springs
9:45-10:15	Break	
10:15-10:30	NSI Overview *F. Rounds*	Crystal Springs
10:30-12:00	NSI Panel Discussion *NSI Staff*	Crystal Springs
12:30-1:30	Lunch	
1:30-2:00	Plenary: Subgroup Agenda Review	Crystal Springs
2:00-5:00	Subgroup Meetings	
	Networking	Sycamore
	User Services	Cedar
	User Applications	Juniper
	Policy	Redwood
	Security	Eucalyptus
1:30-5:00	Exhibit Area Open	Cypress
5:15-6:00	Executive Committee Meeting	Philadelphia
6:30	Dinner	Poppies Restaurant

Agenda

Wednesday, February 13th

8:30-8:45	Plenary: Subgroup Update	Crystal Springs
Network Technology Sessions:		Crystal Springs
8:45-9:15	FTS 2000: A NASA Technology Assessment *J. Klenart /D. Loudon*	
9:15-9:45	Multinet TCP/IP for VAX/VMS *J. McMahon/L. S. Vance*	
9:45-10:15	Break	
Science Networking Keynotes:		Crystal Springs
10:15-10:45	Science Network Resources: Distributed Systems *N. Cline/J. Good*	
10:45-11:15	Using HST: From Proposal to Science *P. Shames*	
11:15-11:45	Galileo Earth Encounter *T. Clarke*	
11:45-12:00	Question and Answer Period	
12:00-1:30	Lunch	
1:30-2:00	Plenary: Subgroup Update	Crystal Springs
2:00-5:00	Subgroup Meetings	Designated Breakout Rooms
	Exhibit Area Open	Cypress

Thursday, February 14th

8:30-9:30	Plenary: Subgroup Summaries	Crystal Springs
9:30-12:00	Closing Session	Crystal Springs
12:00	Adjourn	

Editors' Note Updating the Agenda

- For this conference, the Applications Subgroup was merged with the User Services Subgroup because Applications Subgroup Chairperson Dennis Gallagher was unable to attend the conference.
- The opening plenary session was extended to include a presentation on the NREN by Anthony Villasenor. This presentation was given just after lunch on Tuesday, February 12, 1991.
- The presentation on MultiNet was delivered by L. Stuart Vance.
- The Science Networking keynotes session was extended to include a presentation entitled "Overview of the NASA Astrophysics Data System" by R. B. Pomphrey.

NSIUWG Attendees List
Feb. 26,1991
Total =132

NAME	*Organization/address*	*email*
Aaron, Susan	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	aaron@nsipo.arc.nasa.gov
Albrightson, Joanne	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Anderson, Dan	NASA JSC Bldg 31 Room232 Houston, TX	
Angelici, Gary	PLDS NASA Ames Research Center M/S 242-4 Moffett Field, CA 94035	
Bartoletti, Anthony	Lawrence Livermore Lab P.O. Box 808, L-303 Livermore, CA 94550	
Blair, Steve	LANL Group SST-101 M/S D440 Los Alamos National Lab P.O. Box 1663 Los Alamos, NM 87545	089804@essdpi.span.nasa.gov
Bosovich, Kathy	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	bosco@nsipo.arc.nasa.gov

NAME	***Organization/address***	***email***
Brown, Greg	NASA Ames Research Center Moffett Field, CA 94035	
Brummett, Patti	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Burgan, Jeff	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Burgess, Milo	BCSS PSCN M/S 233-18 NASA Ames Research Center Moffett Field, CA 94035	MBURGESS@NASAMAIL
Calabrese, Angelo	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Champagne, Desiree	SRI International	
Chen, Anny	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Cica, Daniel	NASA Lewis Research Center M/S 142-1 21000 Brookpark Rd. Cleveland, OH 44135	

NAME	***Organization/address***	***email***
Clark, Scott	Assistant Director COSMIC The University of Georgia 382 E. Broad St. Athens, GA 30602	
Clark, Dr. Thomas A.	NASA Goddard Space Flight Center Code 926.9 Greenbelt, MD 20771	clark@tomcat.gsfc.nasa.gov
Clarke, Ted	Galileo Team Leader Jet Propulsion Laboratory 4800 Oak Grove Dr. Pasadena, CA 91109-8099	tclarke@jpl-prince.jpl.nasa.gov
Cline, Neal	User Service Subgroup Chairman IGPP/UCLA Los Angeles, CA 90024	
Cmaylo, Bohden	NASA Ames Research Center M/S 233-11 Moffett Field, CA 94035	
Datlowe, Dayton	Lockheed D91-20 B255 3251 Hanover St. Palo Alto, CA 94304	
Dwivedi, Parmesh	GSFC SSAI 7375 Executive Place, #300 Seabrook, MD 20706	
Ebert, Rick	IPAC/Caltech M/S 100-22 Pasadena, CA 91125	

NAME	***Organization/address***	***email***
Evans, Phil	Univ of Colorado LASP Campus Box 10 Boulder, CO 80309	
Fienier, Elizabeth	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Finch, Chris	Ocean Operations Supervisor Jet Propulsion Laboratory 4800 Oak Grove Dr. Pasadena, CA 91109-8099	
Fisher, Lorraine L.	Lunar and Planetary Institute 3303 NASA Road 1 Houston, TX 77058	
Frank, Zoe	Lockheed 3251 Hanover St. Palo Alto, CA 94304	
Franke, Martin	Headquarters National Aeronautics and SpaceAdministration 600 Maryland Ave, SW,#600 Washington, DC 20024	
Friesen, Lynn T.	The Aerospace Corp. P.O. Box 92957 Los Angeles, CA 90009	
Gagne, Michael	GL/ SCA Hanscom AFB Hanscom AFB, MD 01731	

NAME	*Organization/address*	*email*
Gallagher, Dennis	User Applications Subgroup Chairman-NASA MSFC Mail Code ES53 Huntsville, AL 35812	
Gallagher, Maria	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Gallop, Donald	Supervisor, Network Engineering B602-145 JPL 4800 Oak Grove Dr. Pasadena, CA 91109-8099	
Gary, J. Patrick	NSI User Services Code 930.4 NASA Goddard Space Flight Center Greenbelt, MD 20771	
George, Sanford H.	Network consultant M/S 602-145 JPL 464 W. Woodbury Rd. Altadena, CA 91001	
Gold, Dr. Robert	Applied Physics Lab Johns Hopkins University Johns Hopkins Road Laurel, MD 20723-6099	
Good, John	IPAC/Caltech M/S 100-22 Pasadena, CA 91125	
Granieri, Charles	SLAC M/S 97 Stanford University P.O. Box 4349 Stanford, CA 94309	

NAME	*Organization/address*	*email*
Gutirerez, Robert	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Guzik, T. Gregory	Assistant Professor-Research Dept. of Physics and Astronomy Louisianna State Univ Baton Rouge, LA 70803	
Habra, Dr. Nadim	Manager of Systems Programming NASA Goddard Institute for Space Studies 2880 Broadway New York City, NY 10025	
Hart, Jim	NSI NASA Ames Research Center M/S 233-17 Moffett Field, CA 94035	
Harvey, C.C.	Departement de Recherche Spatiale, Observatoire de Paris-Meudon 92195 Meudon Principal Cedex, FRANCE	
Hatley, Kathy	PSCN NASA Marshall Space Flight Center AI53-4663 Huntsville, AL 35812	
Hewitt, Phil	PSCN	
Hilton, Jim	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	

NAME	***Organization/address***	***email***
Hiu, Grace	**NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035**	
Hood, Matt	**NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035**	
Howell, Steve	**Planetary Science Institute 2421 E. 6th St. Tuscon, AZ 85719**	
Jackson, Lenore	**Mail Code 933.0 NSI NASA Goddard Space Flight Center Greenbelt, MD 20771**	
Jacobson, Mike	**Room 206K Bldg SNCC Louisiana State University Baton Rouge, LA 70803**	
James, Pete	**U.C. San Diego Cass 0-111 La Jolla, CA 92093-0111**	
Jones, Bill	**M/S 233-17 PSCN/NASA Ames Research Center Moffett Field, CA 94035**	
Juhr, Mark	**NASA KSC**	
Kaspar, Pat	**NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035**	

NAME	*Organization/address*	*email*
Klauser, Steven		
Kienert, John	AT&T	
Larrivee, Eric	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Lee, Foo	M/S 233-18 BCSS PSCN/NASA Ames Moffett Field, CA 94035	
Leiner, Barry	Advanced Data Systems 1500 Plymouth St. Mt. View, CA 94043	
Leon, Mark	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Leung, Kinpong	Lunar and Planetary Institute 3303 NASA Road 1 Houston, TX 77058	
Lev, Brian	Mail Code 930.4 NASA Goddard Space Flight Center Greenbelt, MD 20771	
Lewis, Ronald		

NAME	***Organization/address***	***email***
Long, Ken		
Loudon, Dennis	**Boeing**	
Mansur, Doug L.	**Lawrence Livermore Labs** **P.O. Box 808, L-303** **Livermore, CA 94550**	
Marquez, Mylene	**NASA Ames Resarch Center** **M/S ______** **Moffett Field, CA 94035**	
Martin, John	**NSI** **NASA Ames Research Center** **M/S 233-8** **Moffett Field, CA 94035**	
McMahon, John	**TGV, INC** **603 Mission St.** **Santa Cruz, CA 95060**	
Medin, Milo	**NSI** **NASA Ames Research Center** **M/S 233-8** **Moffett Field, CA 94035**	
Miller,Greg	**NSI** **NASA Ames Research Center** **M/S 233-8** **Moffett Field, CA 94035**	
Mobley, Charles	**Mail Code 264-744** **Jet Propulsion Laboratory** **Pasadena, CA 91109-8099**	

NAME	***Organization/address***	***email***
Nylund, Stewart	**JHU/APL** **Johns Hopkins University** **Johns Hokins Road** **Laurel, MD 20707**	
Olive, Pam	**NSI** **NASA Ames Research Center** **M/S 233-8** **Moffett Field, CA 94035**	
Perry, Tom W.	**Deputy Director, Space Physics Division** **Headquarters** **National Aeronautics and Space Administration** **600 Independence Ave** **Washington, DC 20546**	
Pomphrey, Rick	**IPAC/Caltech** **Mail Code100-22** **Pasadena, CA 91125**	
Porteneuve, Elisabeth	**CNET/CRPE** **38-40 rue du Gl. Leclerc** **92131 Issy-les-Moulineaux** **France**	
Porter, Linda	**Network Subgroup Chairman- NASA** **Code ES01** **NASA Marshall Space Flight Center** **Huntsville, AL 35812**	
Poucher, John Scott	**AT&T Bell Labs** **2G231** **Crawfords Corner Rd.** **Holmdel, NJ 07733-1988**	

NAME	*Organization/address*	*email*
Price, Dr. Robert	Mail Code 900.0 NASA Goddard Space Flight Center Greenbelt, MD 20771	
Puku, Deborah	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Purrinos-Escalona, Alfredo	DL-ESS-13 NASA Kennedy Space Center Kennedy Space Center, FL 32899	
Rassam,Dr. Ghassan	Group Director 2000 Florida Ave. Washington, DC 20009	grassamm@agu
Reschke, Chance	IS Manager, USRA Suite 303 West Wing 600 Maryland Ave. S.W. Washington, DC 20024	
Robar, Roberta Ortega	Technology Application Center Univ of New Mexico 2808 Central Ave. S.E. Albuquerque, NM 87131	
Roethig, Tim	Lockheed	
Rosen ,Wayne	Systen Analyist Code 933 NASA Goddard Space Flight Center Greenbelt, MD 20771	

NAME	***Organization/address***	***email***
Ross, Jeff	**Scientific Programmer** **UW Geophysics** **AK-50** **Seattle, WA 98195**	
Rothfuss, James	**Lawrence Livermore Labs** **P.O. Box 808, L-303** **Livermore, CA 94550**	
Rounds, Fred	**NSI Project Manager** **M/S 233-11** **NASA Ames Research Center** **Moffett Field, CA 94035**	
Russell, Yvonne	**NSI** **NASA Ames Research Center** **M/S 233-8** **Moffett Field, CA 94035**	
Sandstrom, Tim	**NSI** **NASA Ames Research Center** **M/S 233-8** **Moffett Field, CA 94035**	
Schneider, Dick	**Mail Code 407.0** **NASA Goddard Space Flight Center** **Greenbelt, MD 20771**	
Schnitzius, John P.	**NASA KSC**	
Sally Schofield	**318 Gladys Ave. #3** **Mt. View, CA 94043**	

NAME	Organization/address	email
Scott, Dan	AI53-4663 PSCN NASA Marshall Space Flight Center Huntsville, AL 35812	
Segrest, Bob	Digital	
Seigal, Marc	Executive VP MAVERICK Communications 29560 Union City Blvd. Union City, CA 94587	msiegel@nsipo
Seiler, Ed	Mail Code 935 NASA Goddard Space Flight Center Greenbelt, MD 20771	
Sharp, Dr. Nigel	NOAA 950 N. Cherry Ave., P.O. Box 26732 Tuscon, AZ 85726-6732	
Shine, Dick	Lockheed	
Shipham, Mark	NASA LaRC M/S 423 Hampton,VA 23665	at AGU
Singer, Dr. Howard	GL/PHG Hanscom AFB, MA 01731	

NAME	*Organization/address*	*email*
Sitbon, Paul	Charge de Mission Institut des Sciences de l'Univers 77 Avenue Denfert-Rochereau FRANCE 75014 Paris	
Skiles, Jay	PLDS NASA Ames Research Center Moffett Field, CA 94035	
Smith, Bruce	NASA Ames Research Center M/S 245-3 Moffett Field, CA 94035	
Solomon, Brad	PSCN NASA Marshall Space Flight Center	
Sommeria, Gilles	Director CNET/CRPE 38-40 rue du Gl. Leclerc 92131 Issy-les-Moulineaux France	
Stark, Laura	M/S 233-18 NASA Ames Research Center Moffet Field, CA 94035	
Stern, Dave	Mail Code 933.0 NSI NASA Goddard Space Flight Center Greenbelt, MD 20771	
Streeter, Roxanne	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	

NAME	***Organization/address***	***email***
Strickman, Mark		
Suther, Lora	Applied Physics Laboratory Johns Hopkins University Laurel, MD 20707	
Tencati, Ron	Security Subgroup Chairman Mail Code 933.0 NASA Goddard Space Flight Center Greenbelt, MD 20771	
Thomas, Steve	*We have no idea who this person is. Only record we have of this person is that he made reservations at the Dunfey and said he was attending the conference. (Maybe he was there for a different conference!)	
Thompson, Joanie	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Thompson, Laurie	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Toy, Neil	M/S 301-345 Jet Propulsion Laboratory 4800 Oak Grove Dr. Pasadena, CA 91109-8099	

NAME	***Organization/address***	***email***
Tran, Thuy	**M/S 264-744 Jet Propulsion Laboratory 4800 Oak Grove Dr. Pasadena, CA 91109-8099**	
VanCamp, Warren	**NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035**	
Vance, L. Stuart	**TGV 603 Mission St. Santa Cruz, CA 95060**	
Van Tue, Tran	**Technical Manager, SPAN-France Institut des Sciences de l'Univers 77 Avenue Denfert-Rochereau 75014 Paris, FRANCE**	
Villasenor, Tony	**NSI Program Manager Headquarters National Aeronautics and Space Administration Mail Code ECI Washington, DC 20546**	
Wade, Lee	**NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035**	
Wakim, Dr. Nagi	**Associate Professor of Computer Science Bowie State University Bowie, MD 20715**	**nwakim@nssdca.gsfc.nasa.gov**

NAME	*Organization/address*	*email*
Wheat, Duane	*We have no idea who this person is. Only record we have of this person is that he made reservations at the Dunfey and said he was attending the conference. (Maybe he was there for a different conference!)	
Wieclawek Jr., Joseph A.	M/S 602-145 Jet Propulsion Laboratory 4800 Oak Grove Dr. Pasadena, CA 91109-8099	
Wiersma, Al	NSI NASA Ames Research Center M/S 233-8 Moffett Field, CA 94035	
Willett, Jim	Space Physics Division Headquarters National Aeronautics and Space Administration	
Winkelman, Jim	NOAA 325 Broadway R/E/SE Boulder, CA 80303	
Withington, Neville (Frances)	USNO Code AA Time Service Dept. Washington, DC 20392-5100	
Wong, Carla	Headquarters National Aeronautics and Space Administration	

NAME	***Organization/address***	***email***
Worrall, Bill	**ISTP Project Bldg 6 Room s226 NASA Goddard Space Flight Center Greenbelt, MD 20771**	
Wrape, Jimmy	**PSCN**	
Yau, Andrew	**NRC Canada 100 Sussex Dr. Ottowa, ONT KIA OR6**	
Yentis, Daryl	**Naval Research Laboratory Code 4122; 4555 Overlook Ave., SW Washington, DC 20375-5000**	
Zanley, Nancy	**NSI NASA Ames research Center M/S 233-8 Moffett Field, CA 94035**	
Zwicki, Ron	**NOAA/ERL/SEL 325 Broadway Boulder, CA 80303**	

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II. Meeting Summaries

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NSI User Working Group Overview

Ronald D. Zwickl/NOAA/SEL
NSIUWG Chairperson

The NSI Users Working Group meeting was held at the Dunfey Hotel in San Mateo from Tuesday morning until noon on Thursday, February 12-14, 1991. The meeting was originally scheduled for November 6-8, 1990. It was moved to a later date because of the delay in signing the FY91 budget into law, and the associated uncertainty in travel for government employees.

Prior to the original (and postponed) meeting, the largest mailings, including both electronic and regular US Mail, to date were made. More time and effort went into preparing the information packet than past meetings, with the initial agenda in place far in advance of the meeting. All these efforts offered mixed results. The attendance, for a non-east-coast meeting, was larger than any previous meeting, but only by a small margin. We had hoped for a larger turn out. Thus, we know a large number of people had been reached, yet only a small number of them attended the meeting. Is this the sign of success (the network works, so why attend); the sign of confusion (just what is the meeting all about); or perhaps the lack of money (NSI does not pay expenses to travel to the meeting and while it connects users to the network it does not fund them).

This meeting contained an expanded format compared to previous NSI and SPAN Users Meetings. The Executive committee met the day before the opening session to review the agenda and discuss any last minute changes. At that time a decision was made to merge the User Services with the User Applications subgroup, with Neil Cline as the Chair. Dennis Gallagher, Chair of the User Applications subgroup was unable to obtain travel funds from the group he works with at MSFC.

The first two days of the meeting contained the usual mix of a project overview, informative talks, subgroup discussion periods, and the final rap-up plenary session. A new addition at this meeting was the presence of Exhibitors. In the past we have had 'special demonstrations', but this year we had the first attempt at including vendors (see list of exhibitors elsewhere). The Exhibit area included several live links to Internet and SPAN, which were always busy.

The meeting contained the normal lively discussions and the specific 'findings' from the subgroups. These findings were given during the final Plenary session discussion and can be found in the subgroup report section.

This meeting marks the shift of focus of the Users Working Group from a heavy emphasizes on network engineering to increasing interest in User Services. The general feeling was that future meetings should focus more on what NSI could do for the User in the say of on-line services. This is not to say that 'networking' is solved, because the network will continue to evolve. However, it is time to increase our attention to end Users.

Policy Subgroup Summary

Ron Zwickl/NOAA/SEL
Policy Subgroup Chairperson

The NSI Users meeting followed the format of previous meetings with subgroups meeting in parallel in the afternoon Tuesday and Wednesday to discuss specific interest topics. During the first afternoon, the entire discussion period was devoted to understanding today's role for the NSI Users Working Group. This was a natural topic to discuss given the magnitude of the changes that have taken place within the networking project during the last year. The current size of the NSI, its more formal way of conducting business, and the assignment of Users Services to NASA/GSFC, have produced sufficient interest to re-examine the role of users in Todays NSI. The discussion on the second day covered a host of other issues. A short summary of the specific "findings" presented to the entire Users Group on Thursday morning is given below:

1. The prime function of the NSI Users Group is information exchange between users and the project.

    a. In standard NASA language, the group is not considered an advisory group; it is a group than can supply "findings".

    b. It is important that a good working relationship be established between the users and the project. The policy subgroup feels that there is still room for improvement in this area.

    c. The NSI Office should share their list of concerns/questions where user input is wanted/needed.

    d. Users should share their list of concerns/questions where project input is wanted/needed.

2. The Users Group should focus on present and future directions.

    a. Need to help identify future User Requirements.

    b. Are current concerns being addressed?

3. The Users Working Group is considered the "Grass Roots" level of networking related activities.

4. There is a need to involve the NASA projects (e.g., ISTP) in the user meetings.

5. It may be useful to change the name from a working group to a User Forum . Thus, the group (meeting) could be called the NSI Users Forum in place of NSI Users Working Group.

6. We note that there are certain areas where support provided by the NSI Office has been outstanding. Specific examples include:

   a. Conference Support at meetings, such as AGU and AAS

   b. Support for Galileo flyby

   c. Emergency response, such as their ability to bring LMSO back up after the 1989 Earthquake in Palo Alto

7. The users felt that existing networks should be used, if appropriate, to meet user requirements.

8. It is important to continue to find ways to reach out to NASA sponsored scientists. Good example include the very useful mail matrix and NSI support at major conferences, such as AGU.

9. The users were unable to determine the process within the NSI Office for evaluating and responding to User Group "findings".

10. The NSI Office should continue to support multi-protocols, including TCP/IP, DECNET IV/V, and OSI.

11. To help users focus their discussion during annual meetings, a minimum level of information in several areas, including budgetary should be presented during the project overview. Detailed, line by line items are specifically not requested.

12. We recommend that each subgroup have a Chairperson and a Vice-Chairperson. The Chairperson would be a user, while the Vice-Chairperson would be from the NSI Office. This would promote better User/NSI interaction during annual meetings.

13. All User Group Chairpersons would have limited terms of two or three years.

Network Subgroup Summary

Linda Porter/NASA/MSFC
Network Subgroup Chairperson

The Network Subgroup contained anywhere from 10 to 30 members at this meeting. Topics of discussion included: re-engineering of the NSI-DECnet backbone, interoperability of PSCNI and NSI-TCP/IP, and tail site bandwidth upgrade for sites connected with 9.6 Kbps services. The most time was spent discussing DECnet OSI/Phase V transition topics.

Phase 1 of the re-engineering of the NSI-DECnet backbone will increase available bandwidth from 56 Kbps up to 728 Kbps between the ARC, JPL, and the GSFC field centers. ARC-JPL leg will be 448 Kbps, the ARC-GSFC leg will be 392 Kbps, and JPL-GSFC leg will be 728 Kbps. The actual upgrade will entail moving the NSI-DECnet (SPAN)) backbone, which has always used DEC routers, to the NSI-TCP/IP backbone, which uses routers capable of supporting both TCP/IP and DECnet (creating an NSI multiprotocol backbone). The routers currently in use are manufactured by Proteon, Inc. The issues of this re-engineering centered on how the ability of the users (usually the tail site technical contacts, rather than the scientist) to trace routes through the network transparently, will no longer be possible, since the existing multi-protocol routers do not support a read-only access mode or other method to supply DECnet information. There were several notes in this discussion. Proteon is currently developing software to allow a form of network access that dumps details of DECnet routing information, which was estimated to be due for release in eight months or so. Before this software upgrade is available, however, it will not be possible to trace routes through the network for DECnet. The routers will be "black boxes" in the network to the user. The only temporary work-around will be for maps if the network is to be made available to the users so that they may manually trace route segments. In addition, the Routing Center (RC) managers will be able to trace paths through these routers if there is a problem. The user may call his RC or the NOC for assistance, if necessary.

> Finding 1: NSIO is asked to provide an on-line map of the network containing sufficient DECnet information for users to be able to trace routes on both sides on the multiprotocol routers. It's suggested the map contain DECnet and IP address information, be in postscript format and made available on the NSIPO system and the NSI NIC.

Finding 2: The subgroup asks that the NSIO either develop or acquire software to allow users to trace DECnet routes, and to notify the users when this software is available. If this includes a special program, the NSIO is asked to place the program(s) on the NIC and/or NSIPO systems.

2. Next on the discussion list was a review of tail site upgrades provided by Mark Leon during the preliminary session. The question of who buys the routers (when such are needed) was asked. NSIO representatives present indicated the policy is that the NSIO supplies the routers at no cost to the tail site when such are needed.

3. The "HEP-SPAN" interconnect architecture was described by Milo Medin of the NSIO. This T1 interconnect is supplied by the Federal Interconnect exchange point on the West coast (FIX-W).

4. There was some confusion regarding NSIO directions with respect to OSI transition as presented in the Network Management Retreat results talk. The discussion can be summarized as follows:

   The network subgroup would like to see a clarification of the relationship of the vision statement: "Achieve a single homogeneous network over 3-5 years based on OSI" and the statement that the NSI Project will make "....use of Internet, interim NREN and NREN..." resources to satisfy network requirements.

   And, noting the emphasis on the growing use of non-NASA networks rather than dedicated circuits for network requirements:

   Finding 3: The NSI Office should not lose the ability to install private, dedicated circuits when justified by NASA science requirements.

5. The status of the progress of NSI-IP to PSCNI-IP interoperability (for Space Station user communication to NSI-IP users) was noted as not having changed from last year. The primary impediment has been the "access controlled" (i.e., closed) PSCNI backbone implementation. The PSCN representative present then briefly outlined the PSCN proposal to open the PSCNI backbone (remove the access controls), thereby allowing the two networks to communicate. There are other issues that require further discussion, and an engineering meeting has been scheduled to take place

in early March between NSI and PSCN engineers.

> Finding 4: As we said last year, NSI and PSCN engineers must pursue and solve interoperability issues between the NSI and PSCN backbones so Space Station and NSI-IP users can communicate.

6. Day 2 started with an overview of Phase V/OSI transition. A summary of the discussion following the talk follows:

> The transition to OSI/Phase V should be separated from the issues of pure OSI transition.
>
> The NSI Office must support active planning for Phase V/OSI and the transition.
>
> User sites are looking to the NSI Office for guidelines and coordination.
>
> Finding 5: Recommend the NSIO assign a team to actively coordinate Phase V transition planning with NSI-DECnet backbone and user sites.

Some mechanisms for achieving this were discussed.

Inter-center Coordination: The Inter-center Committee for Computer Networking (ICCN) should form a working subgroup to address Phase V transition issues. Participation of the NSI-DECnet RC managers is proposed.

User Site Coordination: A mail list of the participants at the meeting was generated. RC site managers lists should be appended to this list. Also, a Usenet bulletin board feed will be set up. Users will be notified by mail how to access the bulletin board.

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Security Subgroup Summary

Ron Tencati/STX
Security Subgroup Chairperson

This year's turnout at the Security Working Group was very low. This would seem to indicate that when there are no security incidents present, concern about security on the network wanes. However, the security of the network is heavily dependent on the participation of the node mangers and organization security contacts.

Over the past year, NSI has become involved in many security-related projects with the NASA AIS Program Office. Since very few people attended the working group session, I'll outline the work that is being done in the Security arena, since much of it will affect end-users of NSI:

1. Risk Analysis and Management

   In December of 1989, the GAO produced a report that was critical of the lack of a Risk Analysis of NSI's two major networks. All NSI sites are required to perform a Risk Assessment with the Computer Security Act of 1987. NSI will be working with NIST and Code NTD this fiscal year to produce Network and Tail-Site Risk Analysis and Management guidelines.

2. Security Toolkit Software

   As time and operating systems progress, the VMS ("SPAN") Security Toolkit becomes increasingly outdated. Through Code NTD, NSI is currently engaged in a survey of Security Toolkit software, and will be making available to the user community both UNIX and VMS toolkit software in FY91.

   Doug Mansur from Lawrence Livermore National Labs brought two of his group members to our working group meeting. They presented an overview of LLNL's "SPI" (Security Profile Inspector) software that they are developing under a DOE contract. LLNL's toolkit software currently runs on VMS and UNIX platforms. There was discussion of merging the NASA and DOE efforts together.

3. Security Policies and Procedures

A new NSI Security Policy Document is being written. It is being targetted for release in FY91. This document will more clearly define the roles and responsibilities of a remote site security manager, and will also state the official security policy and incident reporting procedures for systems comprising the NSI. This document will supercede the existing SPAN Security document, and will address security requirements on both VMS and UNIX NSI nodes.

4. NASA Computer Emergency Response Team (NASA-CERT)

NSI is working with NASA AIS Program Manager to develop an incident reporting and handling capability for NASA. NSI has been assigned a lead role in this effort, and is currently a participant in an international, multiagency effort called "CERT System", sponsored by NIST. This group first came into being as a result of the WANK Worm attacks on DECnet in 1988.

User Services and Applications Subgroup Summary

Neal Cline/UCLA/IGPP
User Services Subgroup Chairperson
Acting Applications Subgroup Chairperson

1. Network Requirements Processing

The task of gathering, documenting, and consolidating requirements for NSI connections is now being very effectively handled by the NSIPO. The staff and management deserve congratulations for this success. No problems were reported.

There is a Customer Service Representative (CSR) for each discipline area, and network users are encouraged to make contact with their CSR to establish requirements or obtain information. This system was found to be working well.

2. User Help Desk

The plans for implementation of network users' support services, presented by Lenore Jackson of GSFC were found to be adequate for users' needs. No evident deficiencies were noted.

Telephone and e-mail contacts for "one-stop" support from the NSI User Support Office were publicized. (see slide)

The ability of the NSI to deliver 24 hr. 7 day support for network connectivity was questioned. In particular it was found that the DECnet routing center at JSC did not normally have support outside at prime shift.

3. On-Line Services

a. The NSI NIC

The NSI User Services Office introduced a menu-driven Network Information Center (NIC) implemented by Brian Lev at GSFC, who deserves congratulations for this contribution.

This NIC is expected to satisfy the needs of users of both TCP/IP and DECnet protocols. It will not be necessary to have more than one NIC, except to provide backup (redundancy).

The User Services Office needs input from the users concerning the contents of the new NIC.

b. USENet News Service

It was found that providing a USENet feed for NASA users would be an appropriate service to be provided by the NSI User Services Office.

An NSI newsgroup is recommended as an additional way to disseminate information about NSI services and activities.

c. "white pages"

A prototype X.500 directory services implementation is already in operation at many internet sites and in particular at some NASA centers. It was found that NSIPO involvement is desirable, and that the User Services Office should be actively involved in this key development.

4. Conference Support

The NSI provides network access and associated services at selected science conferences. This service is very important to NASA scientists.

NSI's plans and schedule for future conferences need to be made known to the science community.

Scientists need to know how to make their requirements for future conferences known to NSI. It was found that at present this is done by communication with division chiefs at NASA Headquarters and with the NSI Customer Service Representatives (CSRs).

Excessively costly services at some events may preclude support at others which are needed also. NSIPO attention to costs at each event is needed to insure equitable coverage.

5. Applications

NETWORK applications software should be made available in the NSI

NIC. An example is data compression, which improves network file transfer efficiency.

Application standards should have visibility in the NSI NIC. On the other hand it was found that the establishment or promotion of specific application standards is not an appropriate function of the NSI.

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III. Presentation Material

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A. Opening Session Remarks

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NASA SCIENCE INTERNET USERS WORKING GROUP OPENING SESSION REMARKS

Ron Zwickl, Chairman

Welcome

- Yearly Meeting
- Key People
  - Subgroup Chairs

    Linda Porter - Networking
    Neal Cline - User Services
    Ron Zwickl - Policy
    Ron Tencati - Security

  - Fred Rounds - NSIO

    Project Manager, NSI

  - Susan Aaron - NSIO

    NSI Conference Coordinator

  - Lenore Jackson _ NSIO

    NSI Proceedings Coordinator

INTRODUCTION

What Are We?

- Users Group
- Represent "All Walks Of Life" (Within OSSA)

Why Are We Here?

- Information Exchange
  - With Each Other
  - With NSI
- Voice User Concerns/Issues

Why Are There Subgroups?

- Allows Full Discussion
- Covers Different Interests
- Change With Time

HISTORY

"Communicate And Increase Productivity For Scientists"

1980
- "Needs"
- Scan
- SPAN

1985
- First Project Use
- Ice Comet Encounter
- NSN

1988
- NSIPO

1990
- Management Retreats - Overview by Jim Hart, NSI

MEETING GOALS

- Discuss Today's Issues
    - As Seen By Users
- Information Exchange
    - With NSI
    - With Each Other
- Forward Concerns To NSI
- Publish Proceedings

B. NSI Project Presentations

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NSIUWG

Science Networking Retreat

Jim Hart
Assistant Chief, Information and Communications Systems Division
February 12, 1991

Overview

Sponsor:

Ray Arnold, Chief, Code SC Headquarters

Purpose:

Study, Identify Alternatives, Recommend for Science Networking:

- **Vision,**
- **Roles and Responsibilities, and**
- **Technical Approach and Transition**

Retreat dates:

June 7, 1990

July 30, 1990

Implementation Status:

Draft "White Paper" being prepared

Management and technical implementation in progress

Participants

Dr. Robert Price	Deputy, Earth Sciences Directorate (900), GSFC
Tony Villasenor	Program Mgmt, Science Networks, Headquarters SCI
Jim Hart	Manager, NSI, Ames (ED)
Dr. Jim Green	Manager, NSSDC, GSFC (930)
Sandy Bates	Program Mgmt, Headquarters PSCN (OS)
Rick Helmick	MSFC, PSCN (AI)

Ray Arnold, Joe Bredekamp: Management support as needed

Vision

Science Networking is End-to-End service under OSSA management.

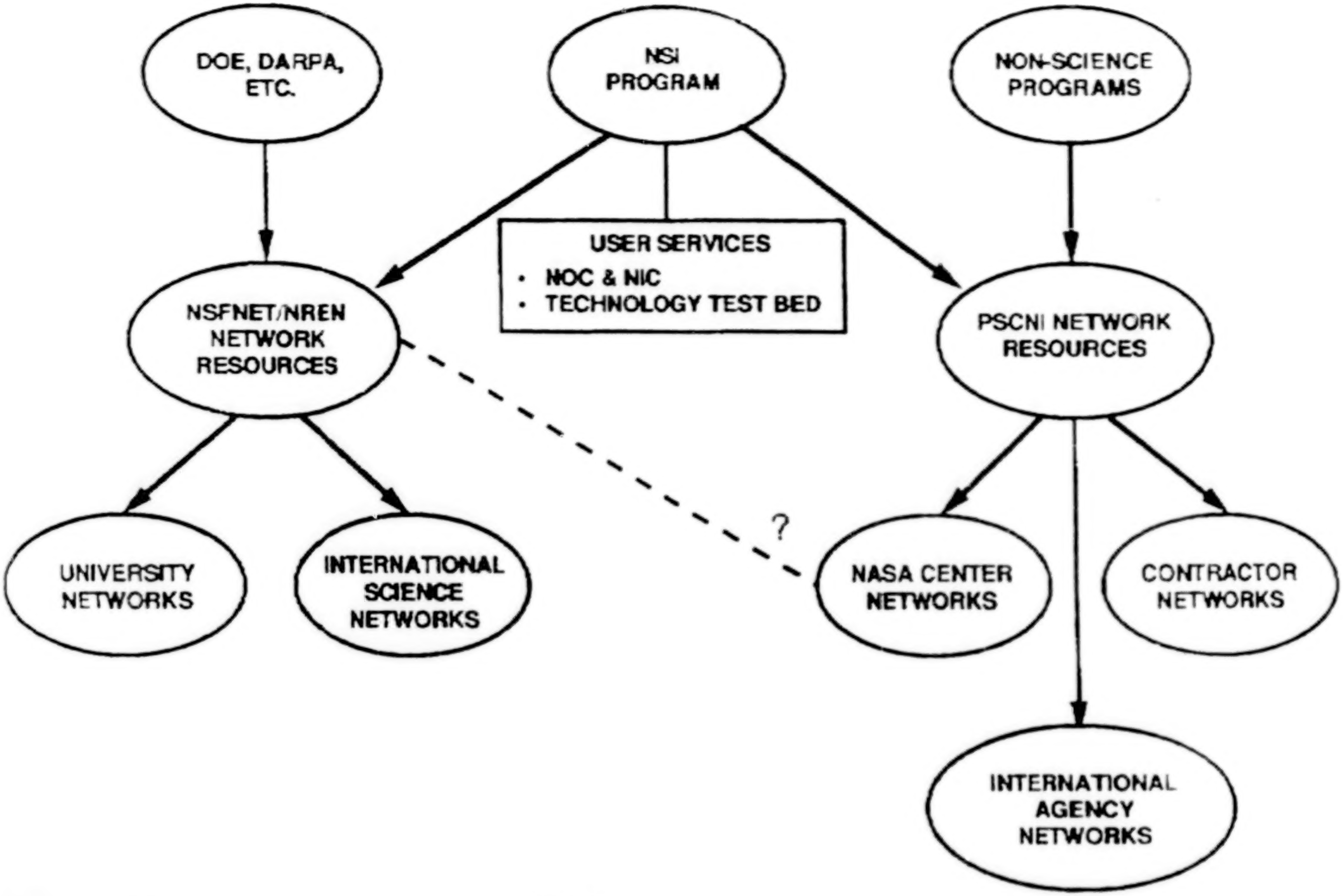
OSSA direct efforts to achieve single homogeneous network over 3-5 years, based on OSI.

Cooperate with other agency efforts to achieve single agency-wide network over 8-10 years. (Create Inter-Center Coordinating Comm)

Upgrade current science network to basic service offering of 56kbps tails and T1 backbone circuits.

Provide service for both Science Data Operations (Mission Essential and Mission Success) as well as general research and analysis communities.

OPERATIONAL MODEL FOR INTERNETWORKING NASA


DOE, DARPA, ETC.
NSI PROGRAM
NON-SCIENCE PROGRAMS
USER SERVICES
• NOC & NIC
• TECHNOLOGY TEST BED
NSFNET/NREN NETWORK RESOURCES
PSCNI NETWORK RESOURCES
?
UNIVERSITY NETWORKS
INTERNATIONAL SCIENCE NETWORKS
NASA CENTER NETWORKS
CONTRACTOR NETWORKS
INTERNATIONAL AGENCY NETWORKS

SCIENCE NETWORK

ROLES AND RESPONSIBILITIES - HQ OFFICES

OSO	OSSA
• OVERALL MANAGEMENT OF NETWORKING FOR AGENCY	• MANAGEMENT OF SCIENCE NETWORKING
• INSTALLATION AND MAINTENANCE OF ENTIRE AGENCY BACKBONE	• SCIENCE USER REQUIREMENTS ASSEMBLY AND ANALYSIS
• OVERALL NETWORK ENGINEERING	• SCIENCE NETWORK ENGINEERING AND OPERATIONS
• INTERFACE TO INTERNATIONAL AGENCY NETWORKS	• INTERFACE TO INTERNATIONAL SCIENCE NETWORKS AND U.S. NON-NASA NETWORKS
	• USER SERVICES AND APPLICATIONS DEVELOPMENT

SCIENCE NETWORK

ROLES AND RESPONSIBILITIES - CENTERS

ARC

- NSI MANAGEMENT
- NSI ENGINEERING
- NSI OPERATIONS
- CONNECTIVITY TO INTERNATIONAL SCIENCE NETWORKS
- CONNECTIVITY TO NSF, NREN, AND UNIVERSITY NETWORKS

GSFC

- USER SUPPORT SERVICES
- APPLICATIONS DEV

MSFC

- PSCN MANAGEMENT
- AGENCY BACKBONE ENGINEERING
- PSCN OPERATIONS
- CONNECTIVITY TO INTERNATIONAL AGENCY NETWORKS
- CONNECTIVITY TO CONTRACTOR NETWORKS AND NON-SCIENCE ACTIVITIES

Assignment Summary for Science Networking

Function	Now	Proposed
0.0 Program Management	HQ	HQ
1.0 Project Management	ARC	ARC
2.0 Network Engineering	ARC, GSFC	ARC
3.0 Network Operations	ARC, GSFC+	ARC
4.0 User Support Services	All	GSFC
5.0 User Application Development	None	GSFC

0.0 *NSIPO PROGRAM MANAGEMENT*

(Assigned to HQ)

PROVIDES OVERALL PROGRAM MANAGEMENT AND ADMINISTRATION OF OSSA SCIENCE NETWORKING OBJECTIVES AND GOALS

0.1PROGRAM MANAGEMENT

- POLICYPLANNING
  - USAGE, ETHICS, SECURITY
- STRATEGIC AND ADVANCED PLANNING
  - OSI and NREN
- Program Reviews (regularly scheduled)
- Program Plan

0.3 External Interfaces

- NASA: Code O, R, Centers
- Other NREN agencies: NSF, DOE, DARPA
- National
- International

1.0 *NSIPO MANAGEMENT AND ADMINISTRATION*

(Assigned to ARC)

PROVIDES OVERALL PROJECT MANAGEMENT AND ADMINISTRATION OF OSSA SCIENCE NETWORKING OBJECTIVES AND GOALS

- 1.0 Project Management
  - SSC, User Group, and ICC I/
  - BUDGETING AND ACCOUNTING
  - SCHEDULING
  - PROCUREMENT
  - PERSONNEL PLANNING
  - FACILITIES DEVELOPMENT
- 1.1 USER REQUIREMENTS MANAGEMENT
  - Requirements gathering and validation (NSR Process)
  - MOU development
  - Tracking & Statusing
- 1.2 SECURITY MANAGEMENT
  - Risk analysis
  - Incident investigations
  - External coordination
- 1.3 External Relations
  - PSCN
  - National & International

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2.0 ENGINEERING

Assigned to ARC

- 2.1 Requirements Support
  - Requirements databasing
  - Requirements consolidation
- 2.2 General network engineering
  - 2.2.1 NETWORK ARCHITECTURE/CONFIGURATION
    - Overall architecture
    - Technical i/f with external architectures
  - 2.2.2 DECNET & IP ENGINEERING WORKING GROUPS
    - Design of logical networks (P V conversion)
    - Parameters and addressing
    - Configuration Documentation
  - 2.2.3 SERVICE NSTALLATION and TESTING
    - Network service acquisition, testing, checkout
  - 2.2.4 SECURITY
    - Development & implementation of security measures
    - Development of network security tools
  - 2.2.5 PSCN I/F Representative
  - 2.2.6 TESTBED ACTIVITIES
    - OSI Planning
    - Advanced network technologies
- 2.3 NREN SUPPORT
  - 2.3.1 High Performance Network Technologies

3.0 OPERATIONS

Assigned to
ARC
GSFC

3.1 NETWORK OPERATIONS (ARC)

- 7-DAY, 24-HOUR NETWORK OPERATIONS CENTER (NOC)
- NETWORK MONITORING AND TRAFFIC ANALYSIS
- PROBLEM MANAGEMENT: Reporting, Repair, Maintenance Service
- FLIGHT PROJECTS AND MISSIONS NETWORK SUPPORT
- UPDATES AND MAINTENANCE
- PROPERTY AND INVENTORY MANAGEMENT
- Interface With Remote Site Local Area Networks and Management
- ROUTER HW/SW MAINTENANCE CONTRACTS AND LOGISTICS
- OFF SHIFT SUPPORT FOR NIC
- Security Monitoring, Verification, Auditing

4.0 USER SUPPORT SERVICES

Assigned to GSFC

4.0 USER SUPPORT SERVICES

- Network Information Center (NIC)
- White/Yellow Pages Directory Services
- User Help Desk & HOTLINE (WITH NOC)
- User Information Forums
- NSI User Working Group Coordination & Logistics Support
- Conference Support
- Regional Customer Support
- User Security
  - Inform end users on security policies and plans
  - Distribute "kits" and other security material to all users
- Online Requirements Status Lookup

5.0 NETWORKAPPLICATIONS DEVELOPMENT

(Assigned to GSFC)

5.1 Application Development
- INTEGRATION OF CODE SC INFORMATION SYSTEMS IN NETWORKING
- Interoperability Gateways
- Applications Utilities
- Distributed Applications Development and Support
- Applications Demonstrations
- Development of Host Security Software Tools
- Information Systems Documentation

5.2 Advanced Network Applications
- ADVANCED APPLICATIONS, SUCH AS REMOTE VISUALIZATION, WIDEBAND VIDEO
- X Windows
- Interoperating Databases
- Development of "Super NIC"

Technical Transition Plan

- Science Networking to Maintain End-to-End Service Responsibility
- Convert DECnet Phase IV Science Traffic From 56KBPS "SPAN" Backbone to NSI Backbone. Initially at Fractional T1; Upgrade to FULL T1
- Convert All Tail Circuits to Multi-Protocol Capability at Minimum of 56kbps
  - Support IP, Phase IV and Phase V When Available
  - Replace Single Protocol Equipment With Multi-Protocol or Equivalent
- Reduce Over Time the Number of NASA-Owned (PSCN) Tail Circuits Through Use of Internet, Interim NREN, and NREN Except for Certain Mission Essential Requirements
- Connect NREN to Science Centers and Utilize National Backbone Infrastructure for Primary Routing of Science Traffic

Transition (Science-PSCN)

- Explore and Determine Feasibility of Utilizing Expanded Code OS (PSCN) Services for Science Traffic (Phase V and/or IP) on PSCN Backbone.

- If Technically Feasible,
  - Define "Contract" Relationship With PSCN to Preserve OSSA End-to-End Science Services
  - Define and Test Using Segment Prototype Demonstrations
    - Phase V on PSCNI Backbone (Using Science Phase V Tails)
    - IP on PSCNI Backbone
  - Expand as Desired

- Migrate to Vision

- Technical Meeting: March 4, 1991, Dallas TX

Agency-Wide Responsibilities
Protocol Address Space

Address Space	Agency Coordination
DECnet Phase IV	NSI

Incl. SSF, etc. (Area 48 With Representation on NSI DECnet Eng. Group

PSCN Responsible for End-to-End Service for Their Requirements

IP	NSI

e.g., . . .NASA.GOV and . . .PSCNI.NASA.GOV

NSI and PSCN Responsible for End-to-End Service for Their Requirements

OSI (e.g., Phase V)	PSCN

TBD

NSI and PSCN Responsible for End-to-End Service for Their Requirements

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NASA Science Internet Users Working Group

February 12, 1991
San Francisco, California

Information & Communication Systems Division
AMES RESEARCH CENTER

Agenda

NSI Organization and Highlights - Fred Rounds

Customer Requirements Process - Yvonne Russell

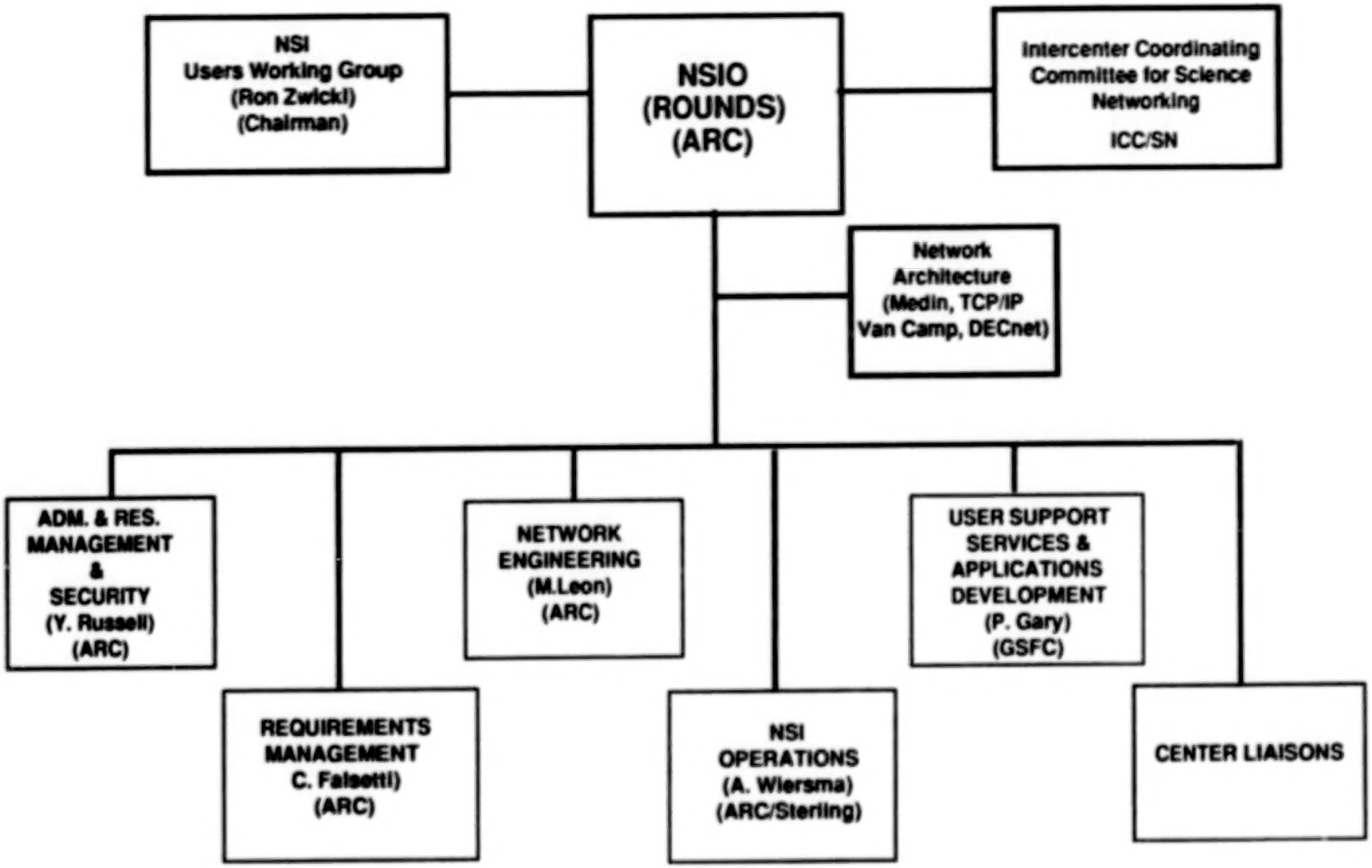
Engineering Review - Mark Leon

User Services - Pat Gary

Security - Ron Tencati

Backbone Upgrades and DEC Equipment Replacement - Warren Van Camp

NSI Project Organization



NSI
Users Working Group
(Ron Zwickl)
(Chairman)

NSIO
(ROUNDS)
(ARC)

Intercenter Coordinating
Committee for Science
Networking

ICC/SN

Network
Architecture
(Medin, TCP/IP
Van Camp, DECnet)

ADM. & RES.
MANAGEMENT
&
SECURITY
(Y. Russell)
(ARC)

REQUIREMENTS
MANAGEMENT
C. Falsetti)
(ARC)

NETWORK
ENGINEERING
(M.Leon)
(ARC)

NSI
OPERATIONS
(A. Wiersma)
(ARC/Sterling)

USER SUPPORT
SERVICES &
APPLICATIONS
DEVELOPMENT
(P. Gary)
(GSFC)

CENTER LIAISONS

2/12/91

NSI

NASA Science Internet

NSI Highlights

Administration

NSI is fully funded by Code S

Project staffing increased 30%

Code S reorganization in process

Engineering

Backbone upgrades planned to serve both DECnet and TCP are in final review

Planning underway to make use of National Research and Education Network

NSI involved in planning for EOS networking

Operations

NSI providing 24X7 operations in new Integrated Network Operations Center

NASA SCIENCE INTERNET

Presentation to
NSI USERS WORKING GROUP
February 12, 1991

Yvonne Russell/Christine M. Falsetti
Customer Service Manager
NASA Science Internet
AMES RESEARCH CENTER

Range of Services

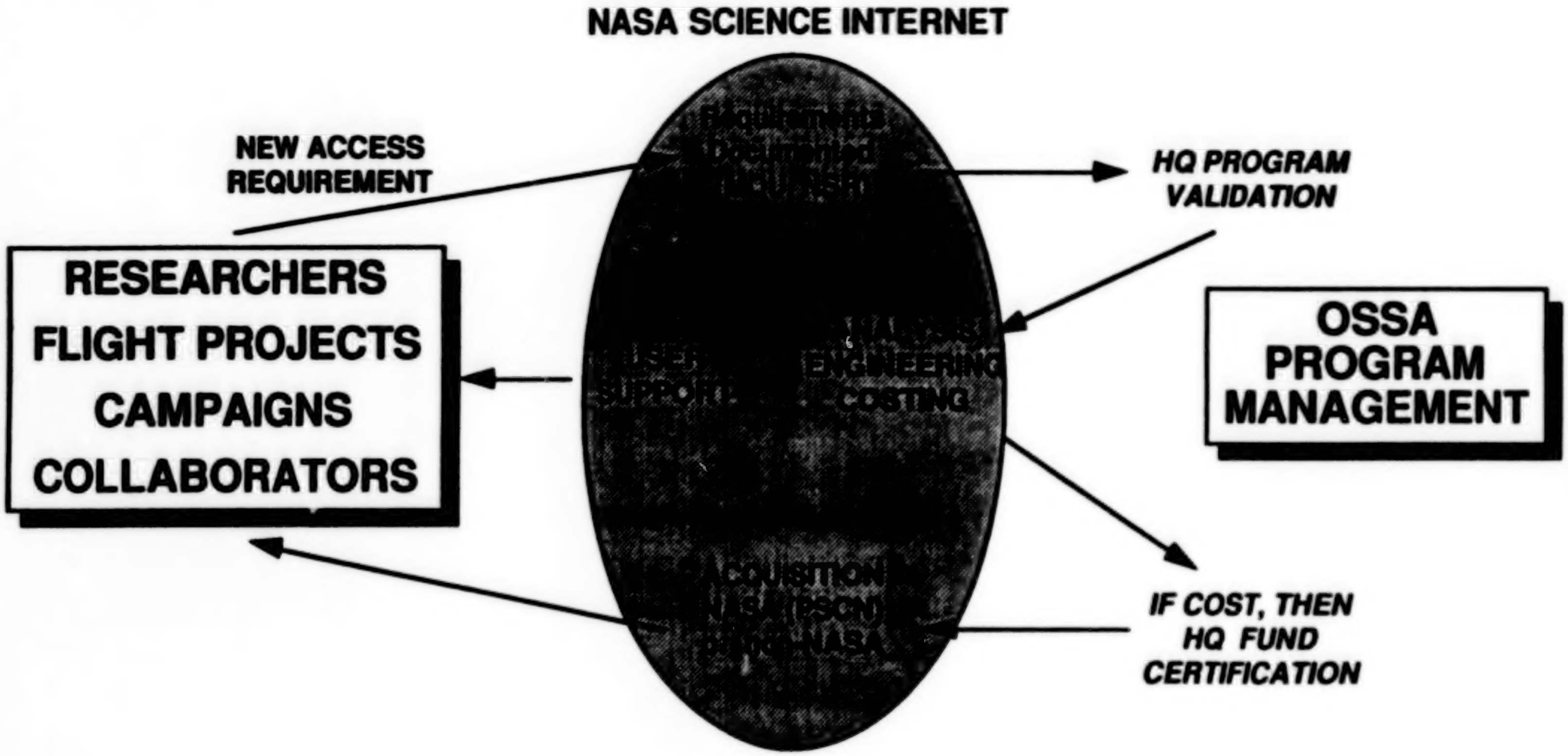
Requirements Management
- Negotiation of Memorandums of Understanding (MOU) with OSSA programs
- Requirements collection, documentation, and tracking

Network Engineering
- Requirements analysis and optimization
- Network design and configuration
- Requirements implementation

Operations
- Maintains 24x7 network monitoring
- Trouble call resolution and tracking
- Reliability and performance validation

Applications Support
- Coordinate Integration of Info. Systems
- Integrate Advanced Applications
- Implement Network Information Services

Project Planning Process



NASA SCIENCE INTERNET

Requirements
Documented
[illegible]

USER
SUPPORT

ANALYSIS
ENGINEERING
COSTING

ACQUISITION
NASA (PSCN)
or NON-NASA

NEW ACCESS
REQUIREMENT

RESEARCHERS
FLIGHT PROJECTS
CAMPAIGNS
COLLABORATORS

HQ PROGRAM
VALIDATION

OSSA
PROGRAM
MANAGEMENT

IF COST, THEN
HQ FUND
CERTIFICATION

Programs/Projects Actively Supported

Life Sciences (SB)

- ***Space Life Sciences 1-4***
- ***Cosmos***
- ***IML-1***
- ***Spacelab J***

Earth Science and Applications (SE)

- Earth Radiation Budget Exposure (ERBE)
- ***Upper Atmospheric Research (UARS)****
- ***Ocean Topography (TOPEX)***
- ***Earth Observing System(EOS)***
- ***Crustal Dynamics*****
- ***WETNET***

Solar System Exploration (SL)

- Voyager
- Magellan
- ***Galileo****
- ***Mars Observer*****
- ***CRAF/Cassini****
- Pioneer

Shuttle Flight Engineering (SM)

- High Resolution Solar Observer

Microgravity Science (SN)

- International Microgravity

Space Physics (SS)

- CRRES
- Dynamics Explorer
- Solar A
- ***Ulysses***
- ***International Solar Terrestrial Physics*****

Astrophysics (SZ)

- Cosmic Background Explorer
- Gamma Ray Observatory
- ***Hubble Space Telescope***
- Kuiper Airborne Observatory
- ***Stratospheric Observatory for Infrared Astronomy***
- Space Infrared Telescope Facility

MOU In progress

****MOU complete***

*****MOU nearing signoff completion***

NASA Science Internet User Working Group

NSI Engineering Review

February 12, 1991

Mark Leon
Engineering Manager
NASA Science Internet
Information & Communication Systems Division
AMES RESEARCH CENTER

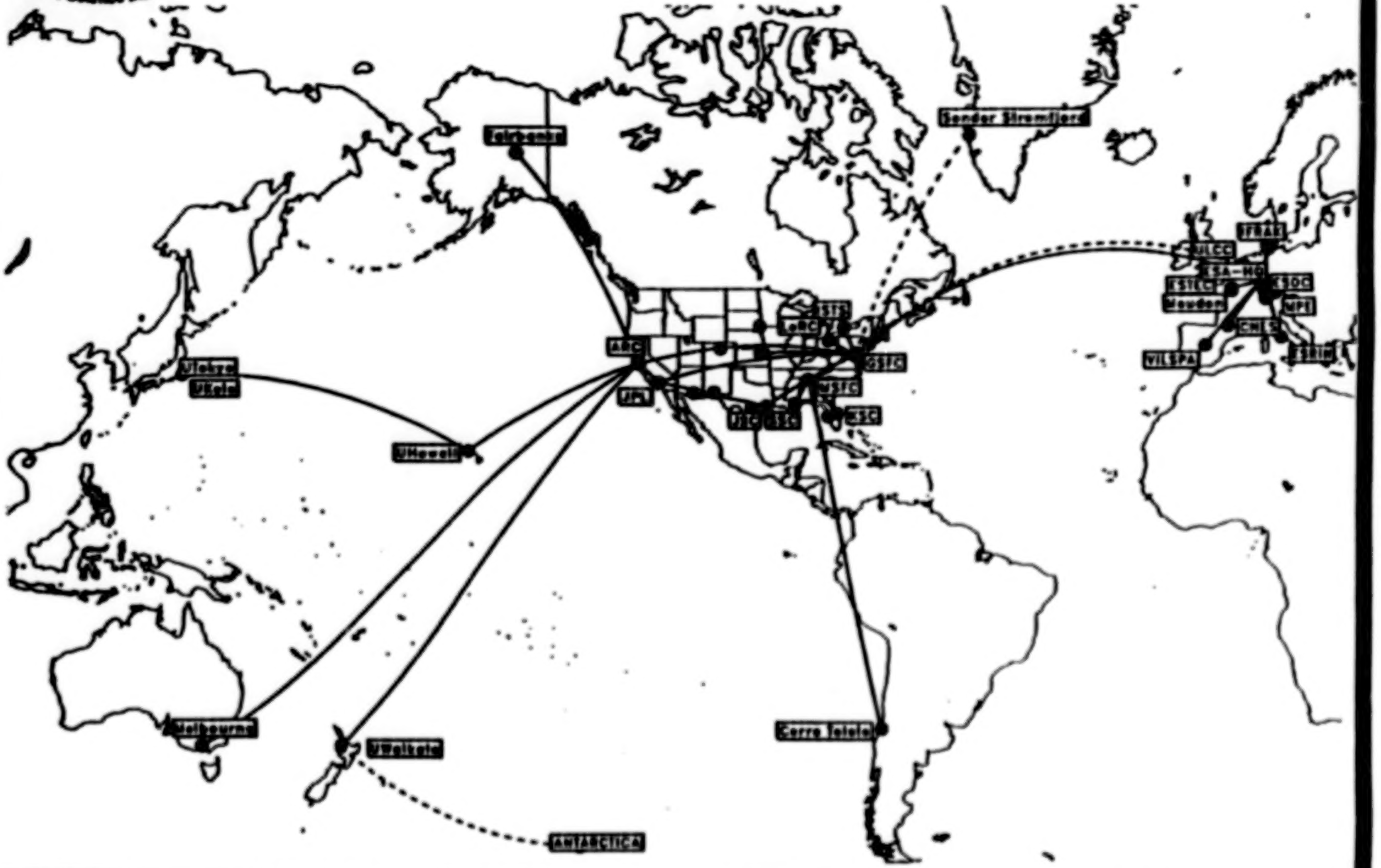
Outline

- Connectivity Status
- Site Upgrades Plans & Progress

New Connections

Tail Site	Hub Site	Bandwidth	Path
National Geodetic Survey, MD	GSFC	56Kb/s	Terr.
Scientific & Technical Information Facility, MD	GSFC	56Kb/s	Terr.
Ford Aerospace, MD	GSFC	56Kb/s	Terr.
University South Florida, FL	KSC	56Kb/s	Terr.
Gilmore Creek Geophysical Observatory, AK	ARC	56Kb/s	Sat.
University Alaska Geophysical Institute, AK	GCGO	56Kb/s	Terr.
Cerro Tololo Inter-American Observatory, Chile	MSFC	56Kb/s	Sat.
Big Bear Solar Observatory, CA	ARC	56Kb/s	Terr.
STX, MD	GSFC	T1	Terr.
Rice University, TX	JSC	T1	Terr.
University Montana	ARC	9.6Kb/s	Terr.
World Weather Building, MD	GSFC	56Kb/s	Terr.
Space Telescope Science Institute, MD	GSFC	T1	Terr
Carnegie Institute of Washington, DC	GSFC	9.6Kb/s	Terr.
United States Geological Survey, Az	JPL	56Kb/s	Terr.
Ellery Systems Incorporated, CO	NCAR	56Kb/s	Terr.

NASA Science Internet


Fairbanks
Sondre Stromfjord
UTokyo
UKeio
UHawaii
ARC
JPL
STS
LeRC
GSFC
MSFC
JSC
SSC
KSC
Melbourne
UWaikato
Cerro Tololo
ANTARCTICA
FRAK
ULCC
ESA-HQ
ESTEC
ESOC
Meudon
MPI
CNES
VILSPA
ESRIN

80

Upgrades Scheduled for 1991

GSFC-Brown Univ. (*)
GSFC-Cornell Univ. (P^56)
GSFC-NASA HQ (*DP56)
GSFC-ST Systems (*T1)
GSFC-Univ. MD (*ET1)
GSFC-Carnegie Mellon (U)
GSFC-NRL (P^)
GSFC-Univ.Rhode Island (P^56)
GSFC-Penn. St. (P^56)
GSFC-NRAO (U)
MSFC-Utah St. (U)
MSFC-Univ. Minn. (P^56)
MSFC-Univ. Chicago (P^56)
MSFC-LSU (PR56)

JPL-NPGS (P^56)
JPL-Univ. Arizona (PRT1)
JPL-USGS, Flagstaff (*56)
JPL-Aerospace Corp. (U)
JPL-NOAO, Az. (*56)
JPL-PSI, Az. (P)
ARC-ISAS, Japan (PR56)
JSC-Univ. Colorado (P)
JSC-LANL (U)
JSC-NCAR (P)
JSC-SWRI (U)
JSC-Rice Univ. (U)

* = Complete
P = In Progress
DP = Dual Protocol
T1 = 1.544Mb/s
U = Under Review

^ = Circuit upgrade planned
E = DECnet Encapsulation
R = Request for service issued
56 = 56Kb/s
( ) = Status

Upgrades Scheduled for 1992 & 1993

Upgrades for 1992

GSFC- Univ. Delaware
GSFC-Univ. New Hampshire
GSFC-WHOI, Mass.
GSFC-Yale University
MSFC-USRA, Ala.
MSFC-Univ. Wisconsin
MSFC-Washington Univ.
JPL-RAND Corp., CA
MSFC-EROS at USGS, SD

Upgrades for 1993

GSFC-Dartmouth Univ., N.H.
GSFC-Grumman, N.Y.
GSFC-MIT, Mass.
GSFC-NRC, Canada
GSFC-NOAA/WDC
GSFC-USGS, Reston
GSFC-Univ. of Delaware, Lewes
MSFC-Augsburg College, Minn.
MSFC-Florida St. Univ.
MSFC-Univ. of Kansas
MSFC-Univ. of Mich.
JPL-Oregon St. Univ.

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NSI Dual Protocol Backbone

Reference: NSI Users Working Group
February 12, 1991

Warren Van Camp

NSI Dual Protocol Backbone

Upgrade DECnet links to match TCP/IP links performance

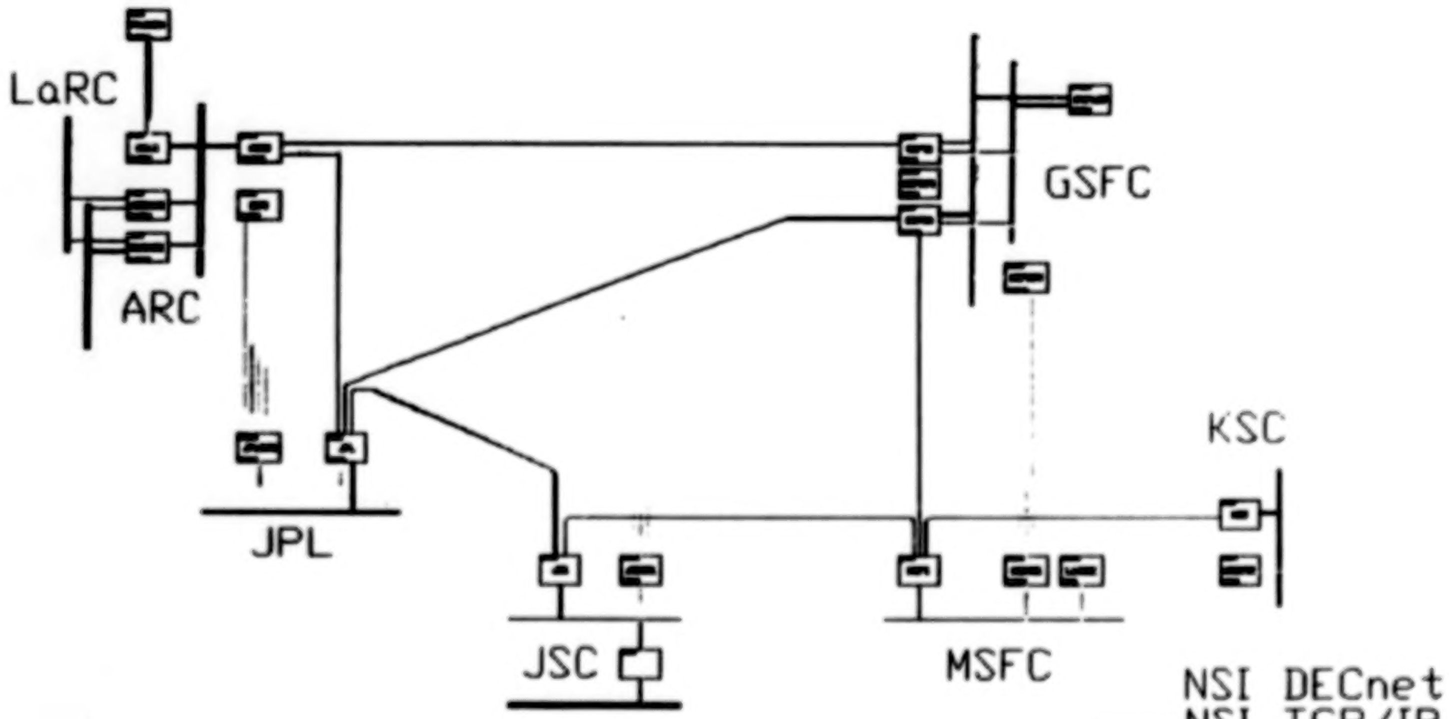
Integrate backbone resources and central management

Transition to be done in two phases

- **Phase 1 - "top triangle" GSFC, JPL, ARC**
- **Phase 2 JSC, MSFC, KSC**

Phase 1 transition plan developed

- **Warren Van Camp, Jeffrey Burgan, Linda Porter**


LaRC
ARC
JPL
GSFC
KSC
JSC
MSFC
NSI DECnet
NSI TCP/IP

NSI Dual Protocol Backbone

Phase 1 transition process

- **Perform necessary reconfigurations**
- **Turn on DECnet routing on NSI Proteon routers as backup path**
- **Change circuit cost for ARC-JPL to use dual protocol as primary**
- **Change circuit cost for ARC-GSFC and JPL-GSFC to use dual protocol path as primary**
- **Monitor and evaluate performance**

NSI
NASA Science Internet

NSI Dual Protocol Backbone

Backbone network operations

- **NSI operations - 24 hours/day, 7 days/week, engineers on call**

DECnet routing equipment

- **NSI is replacing existing DECnet-only routers to provide multiple protocols to tail sites and manage network from 24x7 NOC**
- **Use of existing DECnet dedicated routers may be maintained where only requirement is for DECnet**

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NASA Science Internet (NSI)

User Support Services and Network Application Development

- An Overview -

J. Patrick Gary
Advanced Data Flow Technology Office
Code 930.4
Goddard Space Flight Center

Presentation to
NASA Science Internet User Working Group

February 12, 1991

NSI User Support Services and Network Application Development

- An Overview -

Outline

- Background
- Elements of NSI with GSFC Responsibility
- GSFC Element Objectives
- Summary of Current Status and Plans

NSI User Support Services and Network Applications Development

Background

- At the Network Management Retreat meetings of June and July 1990, key network managers representing Headquarters Codes O and S and the Centers ARC, GSFC, and MSFC concurred on a vision of the future of NASA's science networking and developed major new agreements in regard to the Centers' roles and responsibilities in science networking, including:

ARC	GSFC
NSI Management	User Support Services
NSI Engineering	Network Applications Development
NSI Operations	

NSI User Support Services and Network Applications Development

Background

- On September 27, 1990 the first public announcement and open discussion on the new agreements was made at the NSI Science Steering Committee meeting (The White Paper further describing the agreements, on which prior discussion had waited by management request, is not yet available)

- On October 17, 1990 NSI's Project Manager F. Rounds concurred with the package of GSFC's NSI Work Breakdown Structure (WBS) responsibilities prepared by GSFC's P. Gary.

- On November 7, 1990 F. Rounds forwarded memo to P. Gary to implement NSI program at GSFC.

NSI User Support Services and Network Application Development

Elements of NSI with GSFC Responsibilities

- User Support Services (GSFC Lead)
  - Network User Help Desk
  - On-Line Services Baseline
  - User Conference Support
- Network Applications Development (GSFC Lead)
  - Requirements Definition and Analysis
  - New Core Developments
  - Exploratory Developments
- Additional Tasks Supporting Areas with ARC Lead Responsibility
  - User Requirements, Security, Network Engineering, Network Operations

NSI User Support Services

Network User Help Desk

- First stop for all user questions/problems
- Minimally 12 hours/day, 5 days/week coverage with off-shift support from NOC(1)
- Accessible via phone (301-286-7251, 1-800-NSI-HELP), fax (301-286-5152) and e-mail (NSIHELP@NSINIC)
- Provides assistance in effective use of both DECnet and IP protocol suites(2)
  - Network configuration guidelines for user host systems
  - User guides e.g. e-mail syntax matrix and interoperability gateway usage procedures
- Provides assistance in network user problem diagnosis with on-line access to real-time NSI network status data, NSR and NIC data bases, and trouble shooting tools

(1) Have planned to extend coverage to 24 hours/day, 7 days/week by FY93

(2) Support for the OSI suite has also been initiated, presently is very limited, but will increase as OSI becomes more used

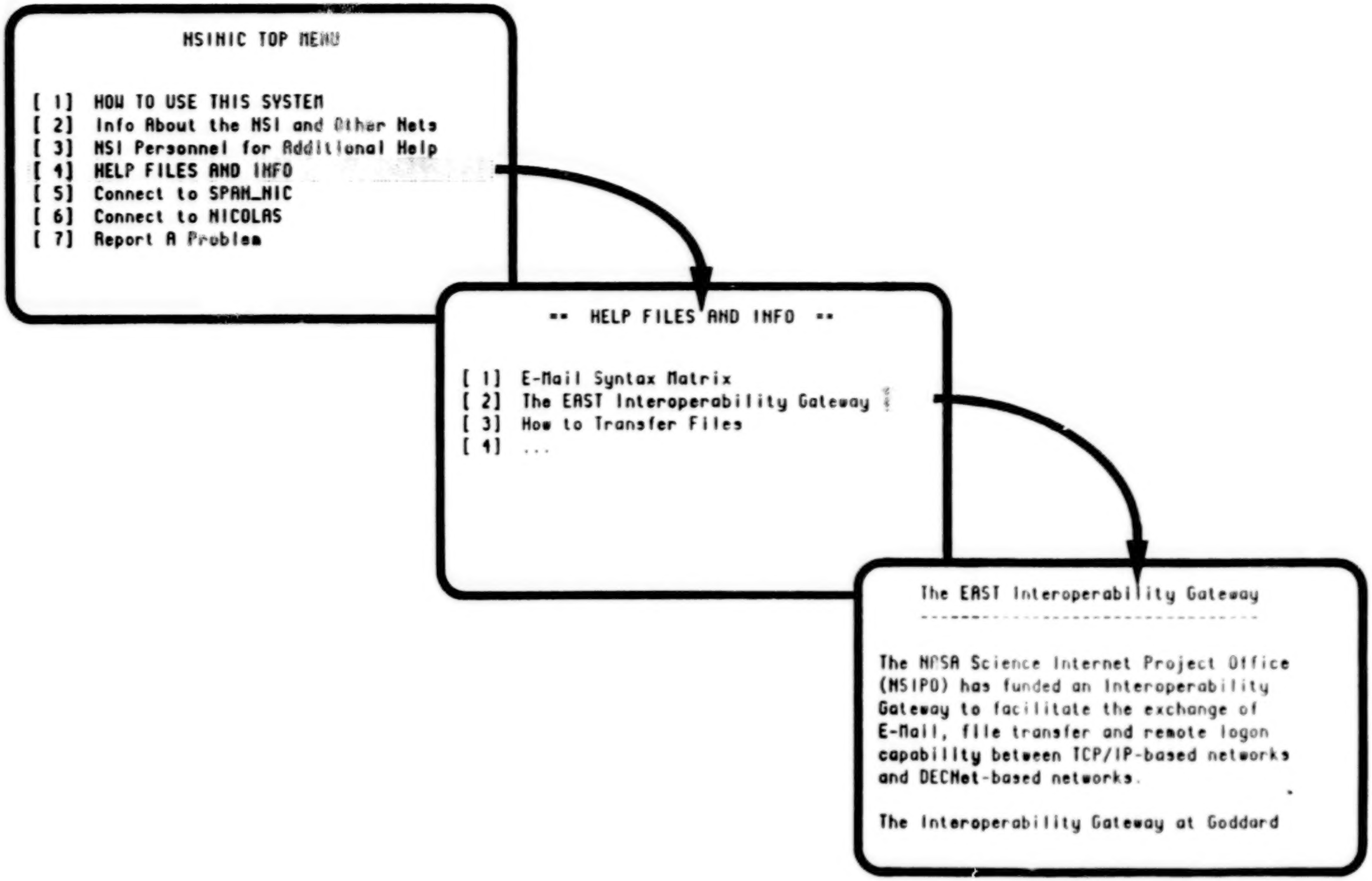
NSI User Support Services

On-line Services Baseline

- Information Servers, e.g., interactive NIC's and Anonymous FTP
  - NSI User Guides addressing systems configuration guidelines and usage procedures for effective network use
  - NSI bulletin board and on-line newsletter
  - NSI circuit usage and performance statistics
  - Updated network applications software, e.g., latest release of X11 windows
  - White and Yellow Page directories
- USENet News Server: general community bulletin board/"conferencing" system
- Interoperability Gateways for e-mail, file transfer, and remote logon among DECnet TCP/IP, OSI, BITNET, X.25
- Remote Node Access Servers, such as NICOLAS and ALEX, to Master Directory, GSFCMail/NASAMail and various Internet/OSSA system resources
- Mail Servers for distributing notices to specific user groups

Sample of User Guide Selection from NSI Network Information Center (NSINIC) Version 1.0 System

First TELNET DFTNIC.GSFC.NASA.GOV (128.183.10.3) or SET HOST DFTNIC (6148),
then enter username NSINIC



```
                NSINIC TOP MENU

[ 1]  HOW TO USE THIS SYSTEM
[ 2]  Info About the NSI and Other Nets
[ 3]  NSI Personnel for Additional Help
[ 4]  HELP FILES AND INFO
[ 5]  Connect to SPAN_NIC
[ 6]  Connect to NICOLAS
[ 7]  Report A Problem
```

```
          **  HELP FILES AND INFO  **

[ 1]  E-Mail Syntax Matrix
[ 2]  The EAST Interoperability Gateway
[ 3]  How to Transfer Files
[ 4]  ...
```

```
     The EAST Interoperability Gateway
     ---------------------------------

The NASA Science Internet Project Office
(NSIPO) has funded an Interoperability
Gateway to facilitate the exchange of
E-Mail, file transfer and remote logon
capability between TCP/IP-based networks
and DECNet-based networks.

The Interoperability Gateway at Goddard
```

DL/JPG-02/01/91

NSI User Support Services

On-Line Services Baseline (Continued) - *Notes on Current Status*

(1) NSI Network Information Center (NSINIC) Version 1.0 in beta release
- Information about the NSI and other networks
- On-Line User Guides, e.g. E-mail Syntax Matrix and EAST Interoperability Gateway (EIG)
- Who to call for additional help
- Auto-Logons to SPAN-NIC (contains SPAN Yellow Pages) and NICOLAS
- Report problem/request help

Anonymous FTP File Server already hosts over 200 Unix, VMS, and Macintosh programs

(2) X.500 based White Pages Server already enabling access to telephone books over 100 organizations

(3) USENet News Server already supporting 84 client systems' accesses to over 750 news groups

(4) EIG supports e-mail, file transfer, and remote logons between DECnet and TCP/IP; NICOLAS extends e-mail and file transfer interoperability to BITNET and X.25 sites and auto-logons to several Internet/OSSA system resources

(5) PMDF based Mail Server already supporting ROSAT and MU-SPIN Projects and GSFC LAN users

NSI User Support Services

User Conference Support

- Provide NSI access booths and assistance at user conferences/scientific meetings, e.g., AGU Conference December 3-7, 1990
- Present NSI capabilities through active participation in user symposia/ working groups
- Demonstrate interoperability solutions
- Present tutorials on effective networking applications
- Make selected site visits for user training
- Provide coordination and logistic support for NSI User Working Group meetings

NSI Network Applications Development

Requirements Definition and Analysis

- Survey/conduct interviews on use/discipline needs
- Survey emerging vendor products
- Survey applicable R&D efforts in the Internet/OSI communities
- Host symposia, working group meetings, and electronic conferences
- Recommend/consult with:
    - Users/disciplines on state-of-the-art in network applications
    - Vendors/developers on prioritized requirements

NSI Network Application Development

New Core Developments

- **Natural extensions to NSI's Baseline services**
- **Largely conducted by NSI "in-house" team**
- **Includes joint development with user disciplines**
- **Often complementary to NSI's Engineering testbed Initiatives**
- **Typical developments:**
  - **New X window applications**
  - **OSI based user utilities such as X.500 based OSSA Resources Guide**
  - **Techniques enabling/enhancing distributed applications**

NSI Network Applications Development

Exploratory Developments

- Significant involvement by wider networking research community
- Protocol extensions and modifications
- Examples of advanced applications:
  - Distributed Programmers Workbench
  - New distributed processing techniques
  - Group communications
  - Remote data visualization and manipulation
  - Interoperating data bases
  - Knowbots and expert systems

NSI Network Applications Development

New Core/Exploratory Development Plans for FY91

- **Mail Exploder System**
  - Either patterned after SolarMail or based on PMDF
  - After development, system can be hosted on NSI or user facilities
  - Dr. Gunther Riegler/SZ targeted as initial user in mid-FY91

- **Utility to Support Distributed Heterogeneous Processing**
  - Simplify use of RPC mechanism to support distributed processing
  - Demonstrate use among VAX, CRAY, and MarPar hosts
  - Dr. Gene Feldman/GSFC targeted as initial user in GSFC DAAC V0

- **Extended FTP Support for Off-line Data**
  - Use familar standard user interface of Anonymous FTP but extend FTP utility to either wait or retry until requested data on off-line CD-ROM is mounted
  - Joint project with HEASARC's Dr. Michael Van Steenberg/GSFC

NSI Network Applications Development

New Core/Exploratory Development Plans

- FY91
  - Develop Mail Server/Exploder such as requested Dr. Gunther Riegler/SZ
  - Develop utilities to simplify distributed heterogeneous processing; demonstrate use in GSFC DAAC V0 application of Dr. Gene Feldman/GSFC
  - Extend FTP support to off-line data in joint effort with HEASARC's Dr. Michael Van Steenberg/GSFC
- FY92
  - Provide X Window based version of NSINIC
  - Expand X.500 based White Pages support for disciplines/projects
  - Initiate X.500 based Yellow Pages support for an on-line OSSA Resources Guide
  - Develop selected applications identified via WBS 5.1 process
- FY93
  - Assess and apply FTAM, Virtual Terminal, and other OSI based applications in NSI's OSI testbeds and operational network
  - Develop additional selected applications identified via WBS 5.1 process

NSI User Support Services and Network Applications Development

Conclusions

- Refinement to the objectives and plans of the NSI elements under GSFC responsibility is on-going and will continue to be influenced by:
    - User input/feedback through meetings with NSIUWG and user discipline programs
    - NSI Science Steering Committee advisory process
    - Support and guidance from NSI Program Manager at NASA OSSA
    - GSFC's allocation of NSI's budget and GSFC staff expertise
- For further information or comments on GSFC's NSI efforts, contact:

J. Patrick Gary
Head, Advanced Data Flow Technology Office
Code 930.4
Goddard Space Flight Center
Greenbelt, MD 20771

301-286-9804; FTS-888-9804
PGARY@DFTNIC.GSFC.NASA.GOV

SDCDCL::PGARY
JGARY in GSFCMAIL
Fax: 301-286-5152

NSI

NASA Science Internet

NSI SECURITY TASK

-OVERVIEW-

RON TENCATI
NSI SECURITY MANAGER
NSI USERS' WORKING GROUP
FEBRUARY 1991
SAN MATEO, CA

NSI SECURITY TASK

AS FUNDED FOR FY90:

POLICIES AND SECURITY DOCUMENTATION
RISK ANALYSIS AND MANAGEMENT
COMPUTER EMERGENCY RESPONSE TEAM
INCIDENT HANDLING
TOOLKIT DEVELOPMENT
USER CONSULTING
WORKING GROUPS/CONFERENCES/COMMITTEES

NSI SECURITY TASK

FY90 STRUCTURE:

Reports to NSIPO/ARC Administration
Separate Task Assigned to GSFC

STAFFING:

Security Administrator, NSIPO/ARC - Yvonne Russell
Security Manager, GSFC - Ron Tencati

Other staffing as required by task by either NASA or contractor personnel.

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NSI SECURITY TASK

POLICIES AND DOCUMENTATION

The Network Policies and Procedures Define the Official Security Requirements for Computer Systems Comprising NSI.

- Official Policy
- Security Guidelines (UNIX, VMS, DECnet, TCP/IP, X.25)

Allows for the establishment of a "Security Baseline" for the network consistent with Federal Laws and NASA Regulations.

Will Draw Upon Existing Documentation Where Applicable.

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NSI SECURITY TASK

RISK ANALYSIS AND MANAGEMENT

Produce NSI Risk Analysis Document. Perform a NETWORK Risk Analysis.

Require Periodic Risk Analysis of Constituent Systems Through Project MOUs. Provide Assistance Where Necessary.

The Computer Security Act of 1987 requires all Federal Computer Systems to perform Risk Assessments at least once every 5 years. Sooner for more sensitive systems.

NIST is under contract with NSI and Code NTD to provide NSI with guidance and assistance in establishing a network risk analysis and management plan.

NSI SECURITY TASK

COMPUTER EMERGENCY RESPONSE TEAM (CERT)

Formed after Morris and WANK Worms hit NSI component networks.

Implements NSI-CERT for distribution of security-related notices, alerts and bulletins, as well as provides for coordinated distribution of software patches.

- Identifies Site Security Contacts
- EMAIL, PHONE and FAX Communication Possible

Interfaces with NASA-wide CERT activity at HQ (Code NTD)

NSI is charter member of Cert System, an International group of Government, Agency and Corporate CERTs.

NSI SECURITY TASK

INCIDENT HANDLING

Provide investigation, coordination, reporting and follow-up for Security incidents.

Provide a place where system managers can report incidents or receive help regardless of operating system.

Interface with NASA Inspector General and other Federal agencies as necessary

NSI SECURITY TASK

SECURITY TOOLKIT SOFTWARE

Provide user community with a set of self-audit tools to improve the security of their systems

Operating -System independent (Two sets of equivalent tools for UNIX and VMS)

Usage endorsed by NSI, recommended by Policy Documentation, but not required for membership in NSI.

FY90: NSI-approved tools first, NSI-developed (maybe) later.

NSI SECURITY TASK

USER CONSULTING

Provide help for users with specific security problems. Receive referrals from NSI User Support Office.

WORKING GROUPS/CONFERENCES/COMMITTEES

Ensure that the security interests of NASA Science Networking are represented as appropriate.

NSI SECURITY TASK

EXTERNAL CONTACTS

Work with, and provide support to other Agencies and NASA Codes to facilitate a common Agency-wide approach to computer security.

NIST:

Under contract by NSI and Code NTD to assist NASA in addressing various computer security issues.

- Analyze NSI and SPAN Risk Management Plans, Recommend modifications to allow NSI approach to match NASA AIS Program.
- Idenfify network threats, survey existing toolkits (NSI and public domain, make recommendation for NSI strategy.
- Review NASA Incident Response Capabilities, assist in the establishment of a NASA agency-wide CERT Capability.

NSI is being used as the model for NASA networks

rdt -10

NSI
NASA Science Internet

National Research & Education Network

TONY VILLASENOR
Manager, NASA Science Networks
Office of Space Science and Applications

NASA

High Performance Computing & Communications

GOALS: STRATEGIC PRIORITIES

Extend U.S. technological leadership in high performance computing and computer communications

Provide wide dissemination and applicatin of the technologies both to speed the pace of innovation and to serve the national economy, national security, education, and the global environment.

Spur gains in U.S. productivity and industrial competitiveness by making high performance computing and networking technologies an integral part of the design and production process.

High Performance Computing & Communications

STRATEGY: INTEGRATING PRIORITIES

Support solutions to important scientific and technical challenges through a vigorous R & D effort

Reduce the uncertainties to industry for R&D and use of this technology through increased cooperation between government, industry, and universities and by the continued use of government and government-funded facilities as a prototype user for early commercial HPCC products.

Support the underlying research, network, and computational infrastructures on which UI.S. high performance computing technology is based.

Support the U.S. human resource base to meet the needs of industry, universities, and government.

High Performance Computing & Communications

PROGRAM COMPONENTS

High Performance Computing Systems (HPCS)
- 1000-fold increase in computing power

Advanced Software Technology and Algorithms (ASTA)
- Grand Challanges applications

National Research and Education Network (NREN)
- R&D and wide-area gigabit communications

Basic Research and Human Resources (BRHR)
- Infrastructure, training, education

High Performance Computing & Communications

NREN 5-YEAR IMPLEMENTATION

- Interconnect Agency networks with 1.5 mbps backbone
- Upgrade multi-Agency backbone to 45 mbps
- Perform R&D to achieve 3 gbps networking capability

MULTI-AGENCY PROGRAM

- NSF, DARPA, DOE, NASA; also NIST, HHS, NOAA & EPA

NREN Program Relationships

The HPCC agencies (NSF, DARPA, DOE & NASA) have demonstrated close collaboration in their networking activities, and they are developing more formal structures for the close coordination needed to ensure success of the NREN.

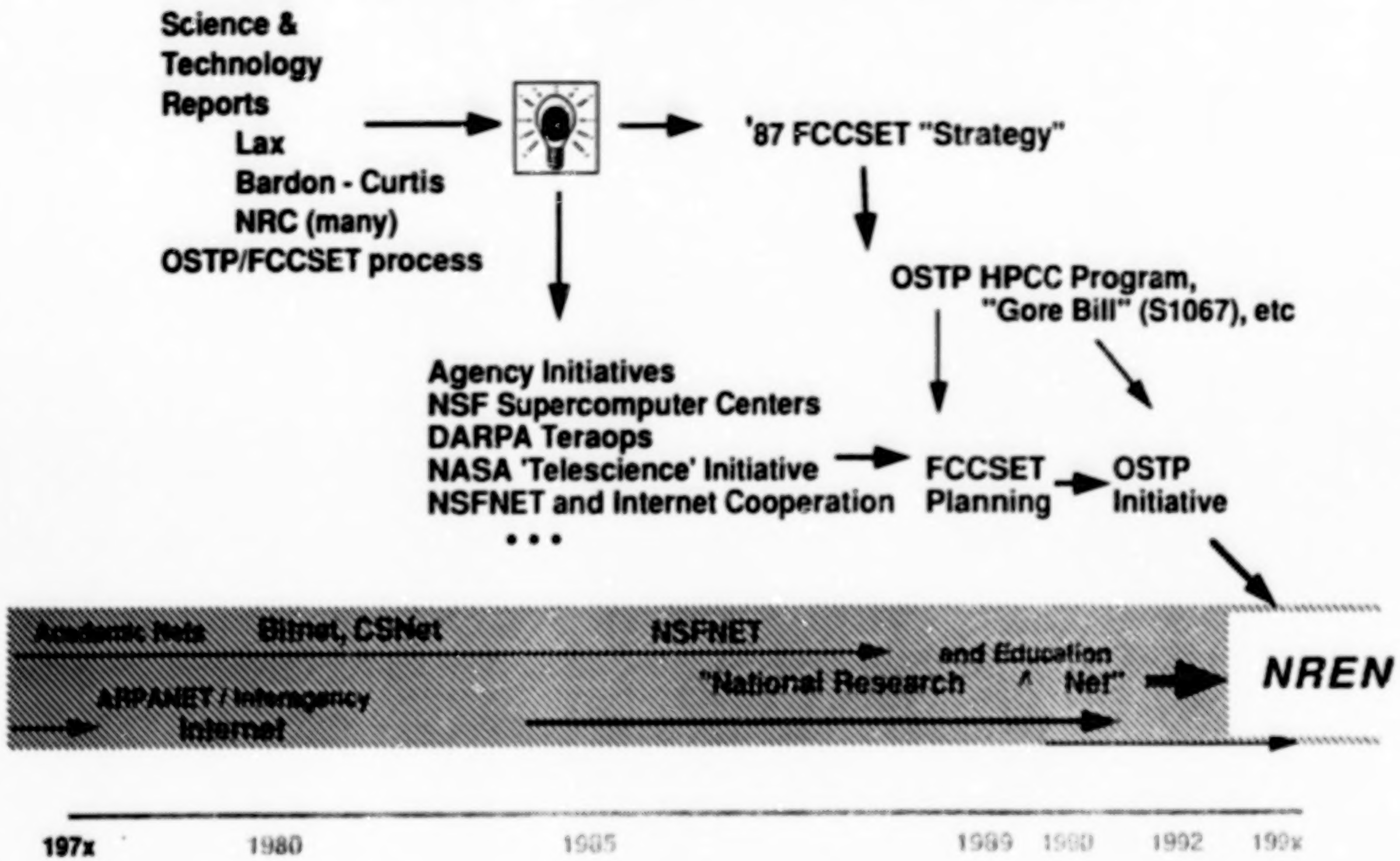
- **DARPA will coordinate gigabit network technology research and development activities in which DARPA, DOE, NASA, NIST, and NSF will participate.**
- **NSF will coordinate the broad deployment of the NREN by working with all participating HPCC agencies through formal structures, such as the FCCSET subcommittees and the Federal Network Council.**
- **In conjunction with the other HPCC agencies, NIST will identify and develop network and security standards.**

The HPCC Program

OSTP-FCCSET 1989

1. High Performance Computers	research on future generations system design tools advanced prototype development evaluation of early systems
2. Software and Algorithms	grand challenge problems SW components and tools computational techniques HPC research centers
3. National Research and Education Network	interim NREN gigabit networking research & deployment transition to commercial service
4. Basic Research and Human Resources	instrumentation and lab improvement education and training basic CS & CE research

A Brief History of HPCC



Science &
Technology
Reports
- **Lax**
- **Bardon - Curtis**
- **NRC (many)**

OSTP/FCCSET process

'87 FCCSET "Strategy"

OSTP HPCC Program,
"Gore Bill" (S1067), etc

Agency Initiatives
NSF Supercomputer Centers
DARPA Teraops
NASA 'Telescience' Initiative
NSFNET and Internet Cooperation
• • •

FCCSET
Planning

OSTP
Initiative

Academic Nets **Bitnet, CSNet** **NSFNET**

ARPANET / Interagency
Internet

"National Research ^ and Education Net"

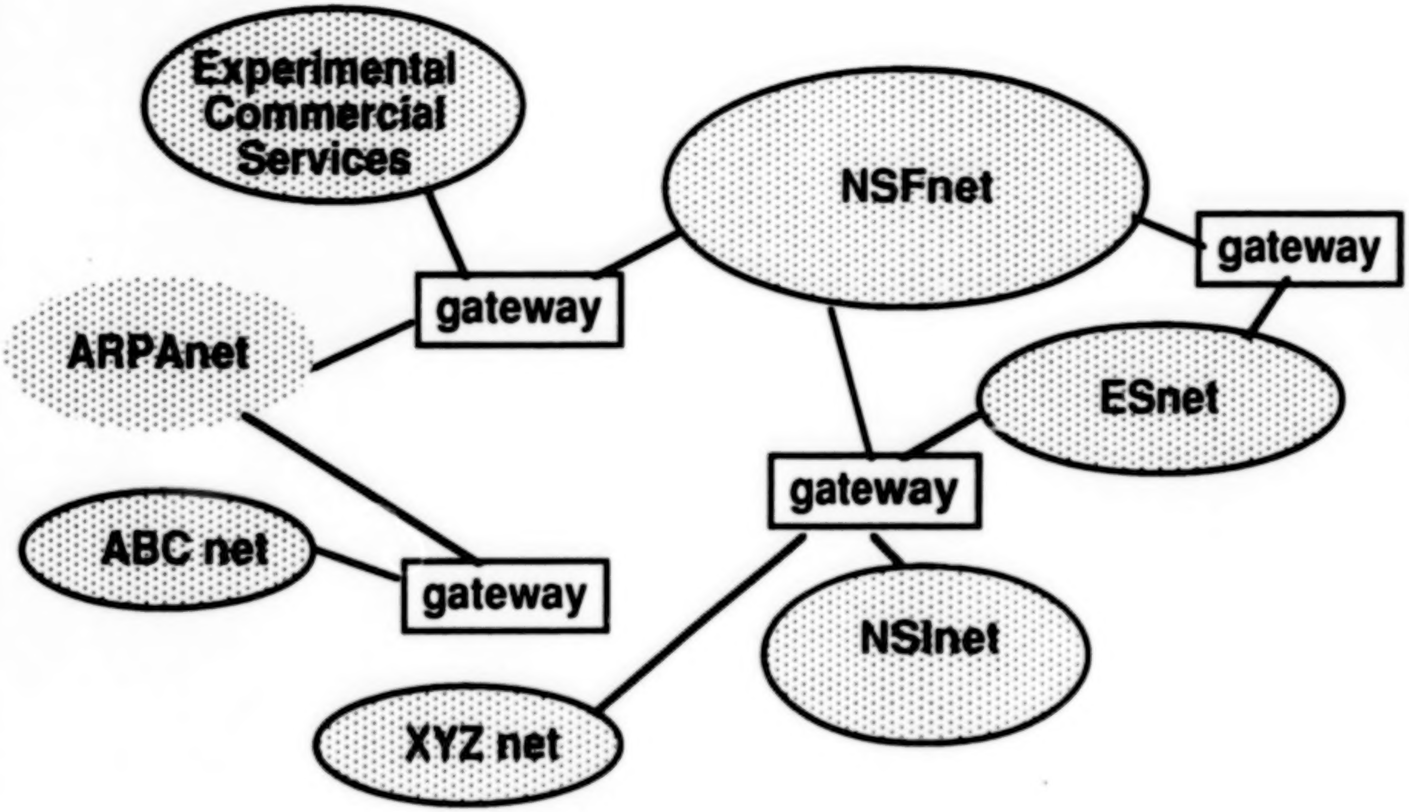
NREN

197x 1980 1985 1989 1990 1992 199x

HPCC Agency Leads

Agency Activity	DARPA	DOE	NASA	NSF
HPC Systems	Parallel Systems; Systems Software Microsystems	Application Testbeds; Systems Evaluation	Application Testbeds; Systems Evaluation	Basic Architecture Research
Advanced Software and Algorithms	Software Tools; Parallel Algorithms	Software Tools; Parallel Algorithms; Access Centers	Software Coordination Visualization Data Management	Software Tools; Database Research Access Centers
National Research & Education Network	Gigabit Research	Network Interconnect	Network Interconnect	Interim , NREN Deployment
Basic Research & EHR	Universities; Industry	Universities; National Labs	Universities; Institutes & Centers	Universities; Research Centers

The Present Internet



Experimental Commercial Services
NSFnet
gateway
gateway
ARPAnet
ESnet
gateway
ABC net
gateway
NSInet
XYZ net

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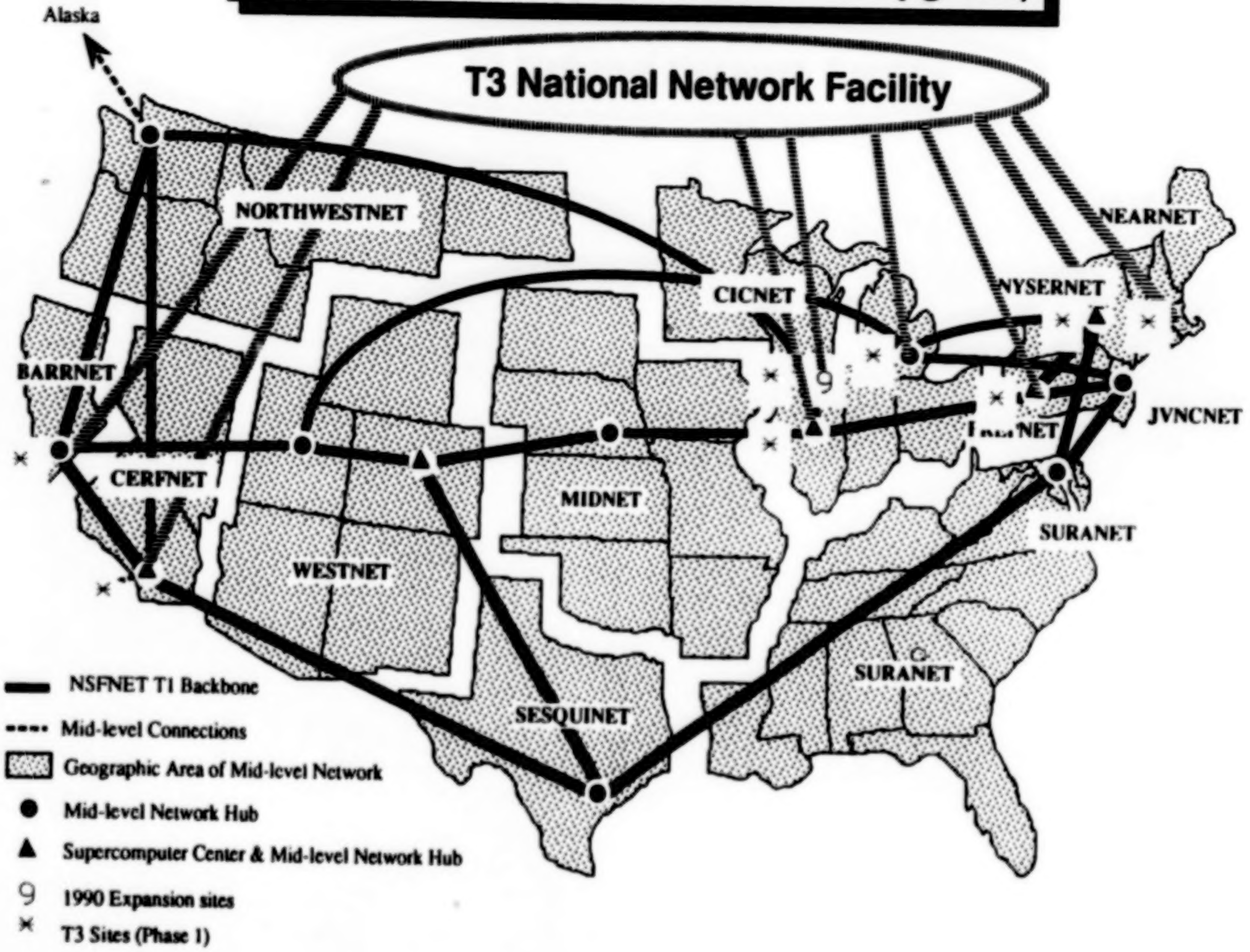
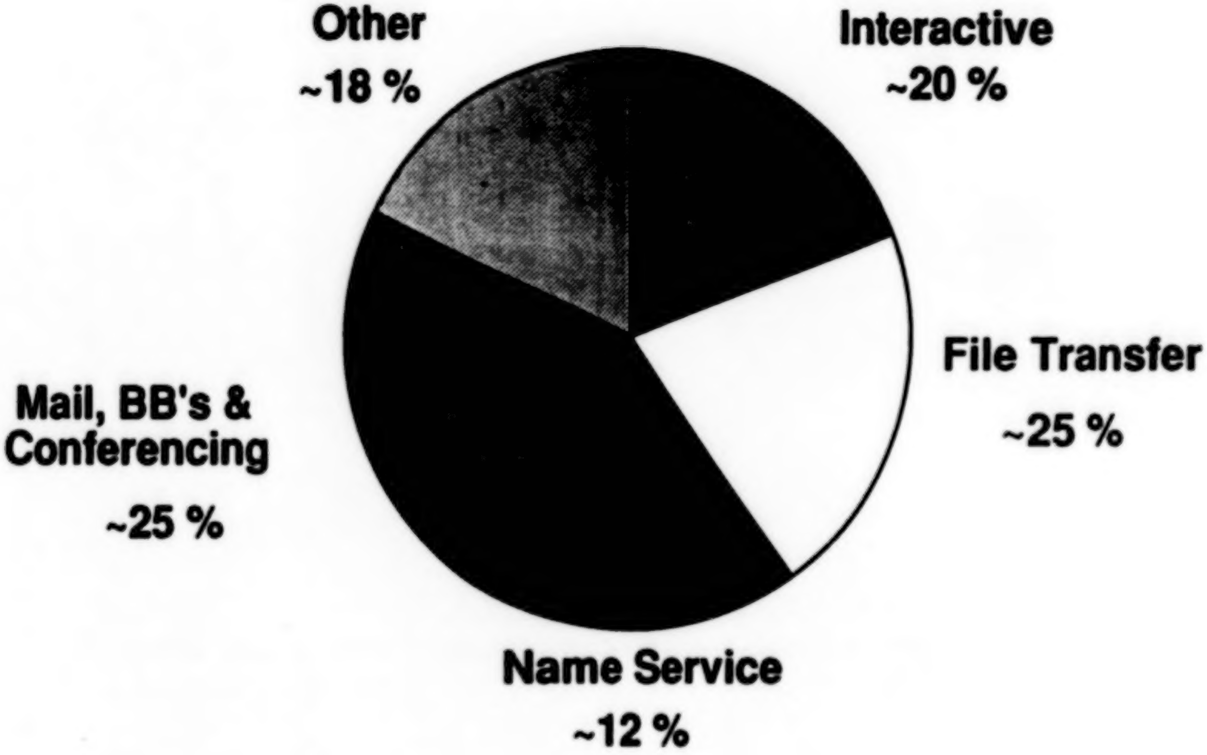
NSFNET

(Including '90 Expansion & Initial T3 Upgrade)

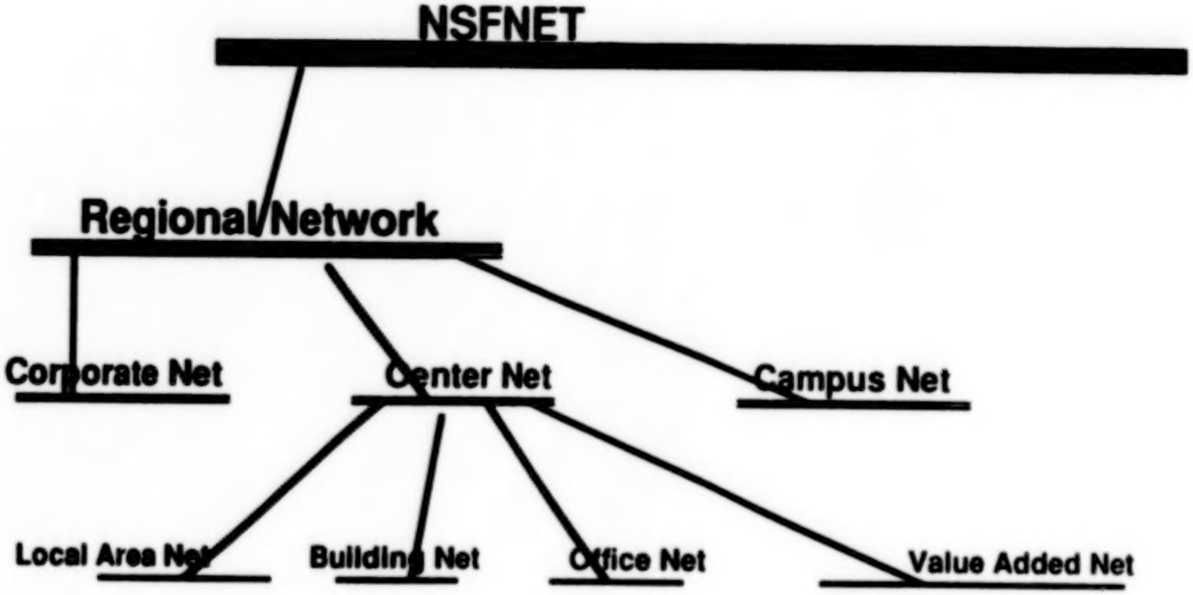

Alaska
T3 National Network Facility
NORTHWESTNET
NEARNET
CICNET
NYSERNET
BARRNET
JVNCNET
NET
CERFNET
MIDNET
SURANET
WESTNET
SURANET
SESQUINET
NSFNET T1 Backbone
Mid-level Connections
Geographic Area of Mid-level Network
Mid-level Network Hub
Supercomputer Center & Mid-level Network Hub
1990 Expansion sites
T3 Sites (Phase 1)

NSFNET Traffic Mix*



* All estimates ± ~2%

National Network Hierarchy



NSFNET

Regional Network

Corporate Net

Center Net

Campus Net

Local Area Net

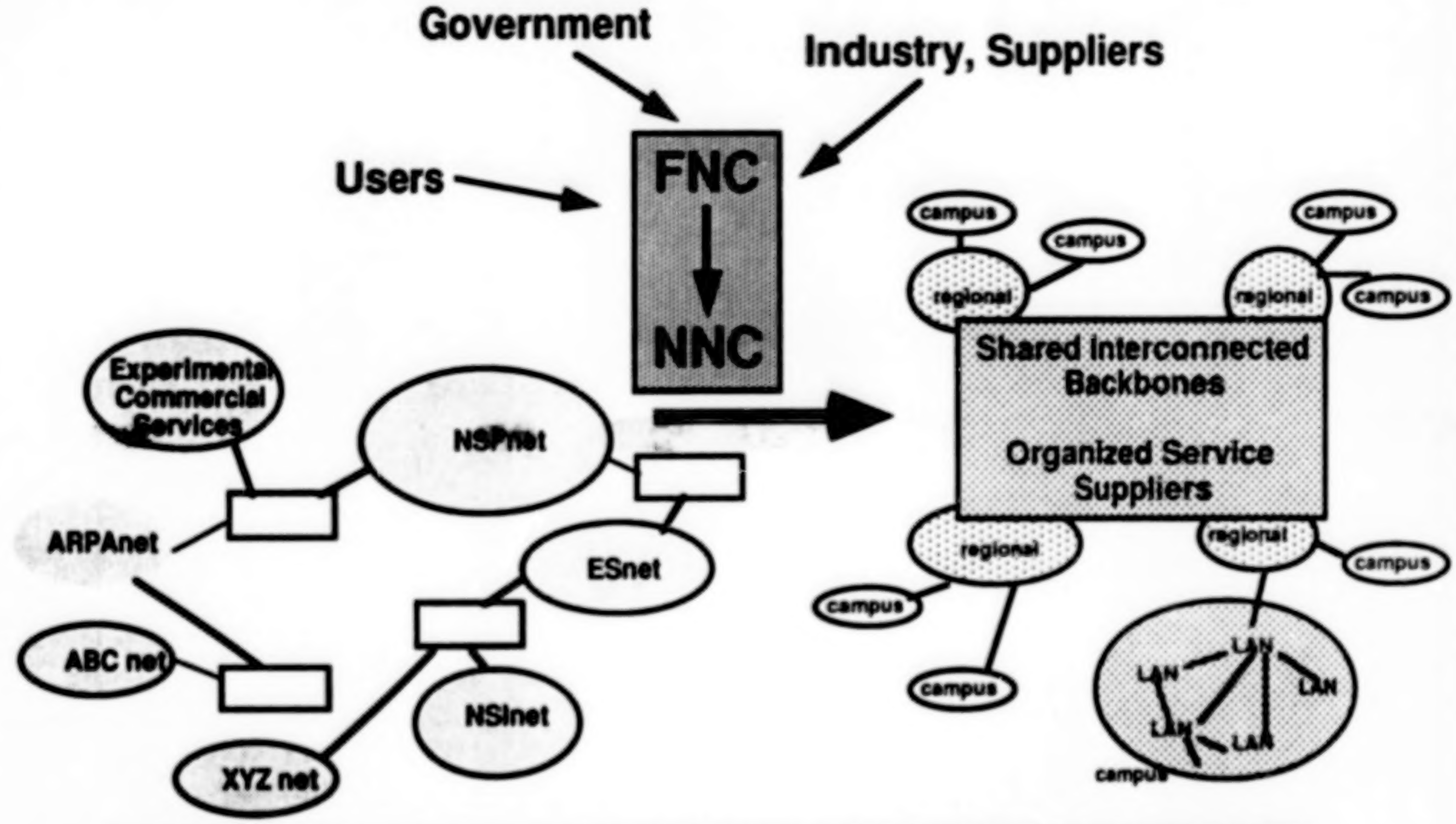
Building Net

Office Net

Value Added Net

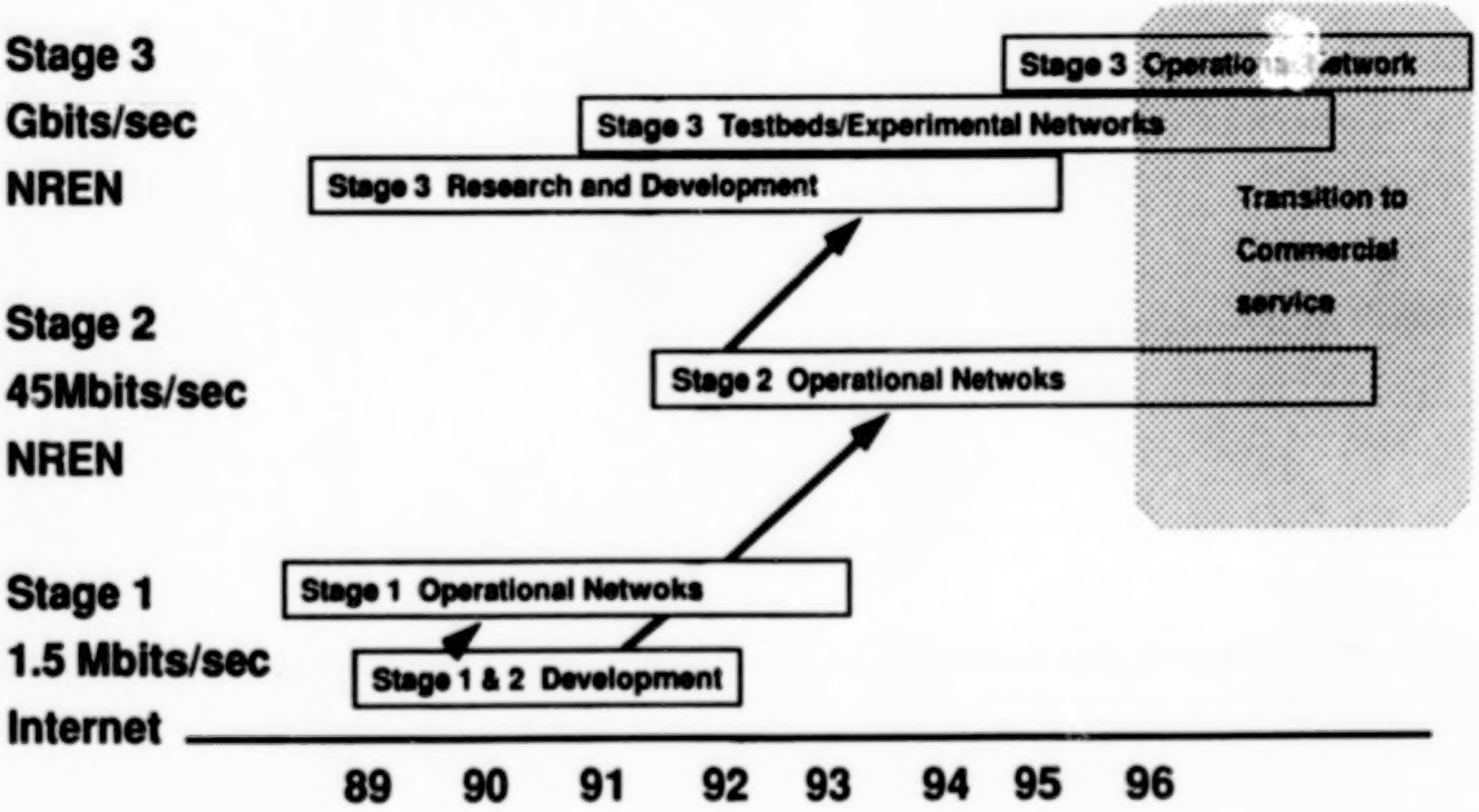
USERS
(electronic mail, file transfer, logon, etc.)

Technical Approach to NREN


Government
Industry, Suppliers
Users
FNC
NNC
campus
campus
campus
regional
regional
campus
Shared Interconnected Backbones
Organized Service Suppliers
Experimental Commercial Services
NSFnet
ARPAnet
ESnet
ABC net
NSInet
XYZ net
regional
regional
campus
campus
campus
LAN
LAN
LAN
LAN
LAN
campus

IF NREN IS FUNDED, THE INTERNET WILL EVOLVE TO NREN

Initial NREN Implementation Plan



Stage 3
Gbits/sec
NREN

Stage 3 Operational Network

Stage 3 Testbeds/Experimental Networks

Stage 3 Research and Development

Transition to Commercial service

Stage 2
45Mbits/sec
NREN

Stage 2 Operational Netwoks

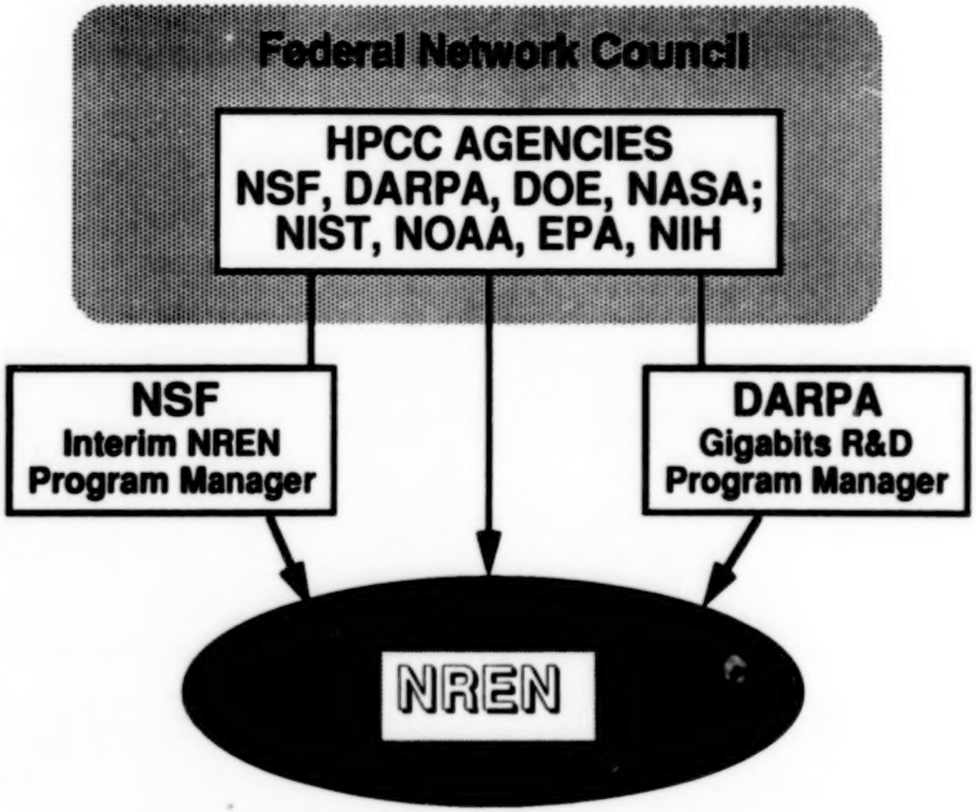
Stage 1
1.5 Mbits/sec
Internet

Stage 1 Operational Netwoks

Stage 1 & 2 Development

89 90 91 92 93 94 95 96

Management Approach to NREN



Federal Network Council

HPCC AGENCIES
NSF, DARPA, DOE, NASA;
NIST, NOAA, EPA, NIH

NSF
Interim NREN
Program Manager

DARPA
Gigabits R&D
Program Manager

NREN

FEDERAL NETWORK COUNCIL
(Charter)

- FORMED by FCCSET Network SubCommittee Chair (Jan, 1990)
- PURPOSE: to establish an effective interagency forum and long-term strategy to oversee the operation and evolution of the Internet and other national computer networks in support of research and education.
- FNC will coordinate with FCCSET to ensure national alignment.
- WORKING GROUPS will be established to support the FNC; members will be limited to Federal employees, Government contractors/grantees, or members of Federal advisory groups.
- FNC will meet at least 4 times per year.

FNC Advisory Committee

FNC, coordinating with OSTP, will establish a charter and formal Advisory Committee representing industry and academia and the national user community; this Advisory Committee will work closely with the FNC to provide guidance in developing the NREN.

CARRIERS

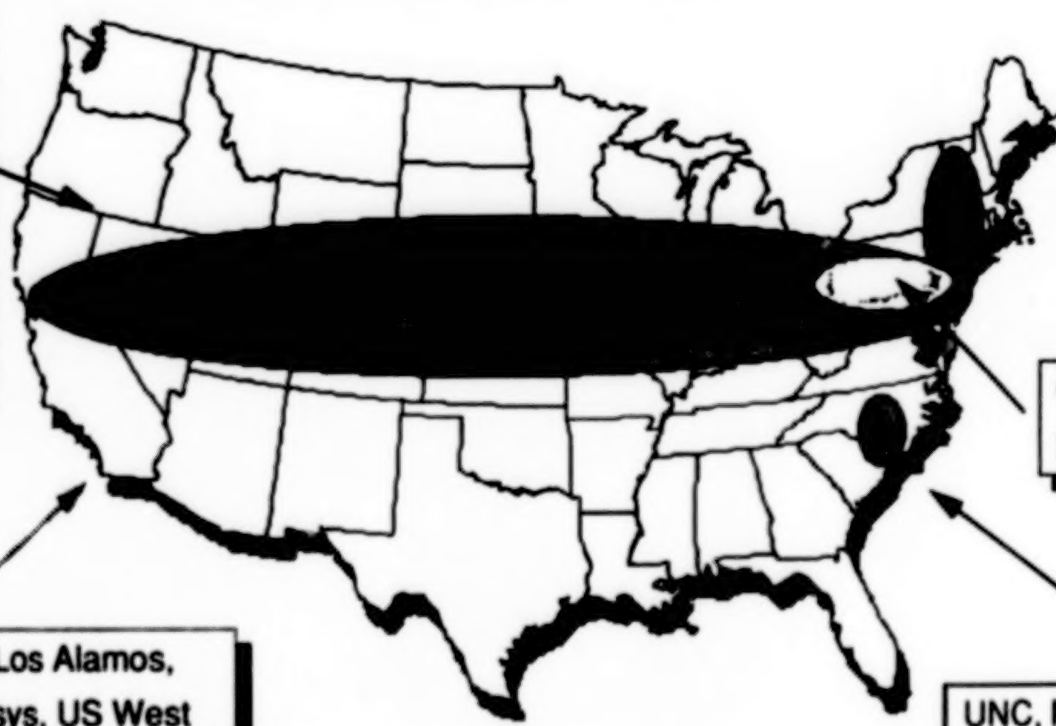
MID-LEVEL NETWORKS

USERS

HARDWARE/SOFTWARE VENDORS

EDUCOM

Industry-University-Government High Speed Network Research Testbeds



UC Berkeley,
LBL, U Wisc,
NCSA,
ATT Bell Labs,
Ameritech,
Bell Atlantic,
ATT, Pac Tel,
US West

MIT, U Penn,
Bellcore, IBM,
Bell Atlantic,
MCI, NYNEX

CMU, PSC,
NRL, Bell Atlantic

SDSC, Cal Tech,Los Alamos,
MCI, Pacific Telesys, US West

UNC, MCNC,
Bell South, GTE

Note: see special report on "GIGABIT NETWORK TESTBEDS",COMPUTER, V.23 N.9, September, 1990, IEEE Computer Society, Los Alamitos CA 90720

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C. Network Technology Sessions

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NASA'S USE OF FTS2000 SERVICES

D. Scott/MSFC-AI53

PSCN Systems Engineering Branch Chief

NASA's Use of FTS2000 Services

- Overview
- Role of Program Support Communications (PSC)
- Status of transition to FTS2000 services
- Issues

NASA's Use of FTS2000 Services

OVERVIEW

- Public law and Federal Information Resources Management Regulation (FIRMR)-60 require NASA to use FTS2000 services that meet NASA requirements
- NASA's single point-of-contact for GSA in all policies and procedures dealing with FTS2000 is Code 0, S. Bates/ Telecommunications Agency Coordinator
- Code O has delegated the PSC program as the focal point for ordering and coordinating all FTS2000 services. The PSC is a Designated Agency Representative (DAR)
- NASA is committed to transition to FTS2000 switched voice and interlata dedicated-circuit services

NASA's Use of FTS2000 Services

ROLE OF PROGRAM SUPPORT COMMUNICATIONS (PSC)

- NASA-wide resource serves:
  - NASA long-distance telecommunication requirements
  - NASA international telecommunication requirements
  - Administrative, scientific, and programmatic requirements

NASA's Use of FTS2000 Services

ROLE OF PROGRAM SUPPORT COMMUNICATIONS (PSC) (CONT)

- Centralized resource management provides:
  - Requirements forecasting and budgets (PSCRD)
  - Engineering design and integration
  - Equipment procurement
  - Installation and testing of telecommunications resources
  - Trouble reporting and maintenance
    - Network Control Center
  - FTS2000 coordination

NASA's Use of FTS2000 Services

STATUS

- Switched-voice service was transitioned at all NASA sites 6/90
- Identified 170+ dedicated circuits to be transitioned starting 5/91. All analog data services will be upgraded to digital service
- Identifying requirements by service type for submission to GSA. This will result in development of implementation plans and schedules for those services that FTS2000 can satisfy
- Transition costs are funded by Code O

NASA's Use of FTS2000 Services

ISSUES

- Intervals for service is now 89 workdays (121 calendar days) after GSA approval
- Backbone diversity is not an FTS2000 offering
- Availability of DS-3 facilities
- Extended Superframe Format (ESF) monitoring of T-1 facilities (facility data link)
- Services not presently available require contract modification (upscale)

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FTS200 Network Architecture

J. Klenart
February 13, 1991

FTS2000 NETWORK ARCHITECTURE

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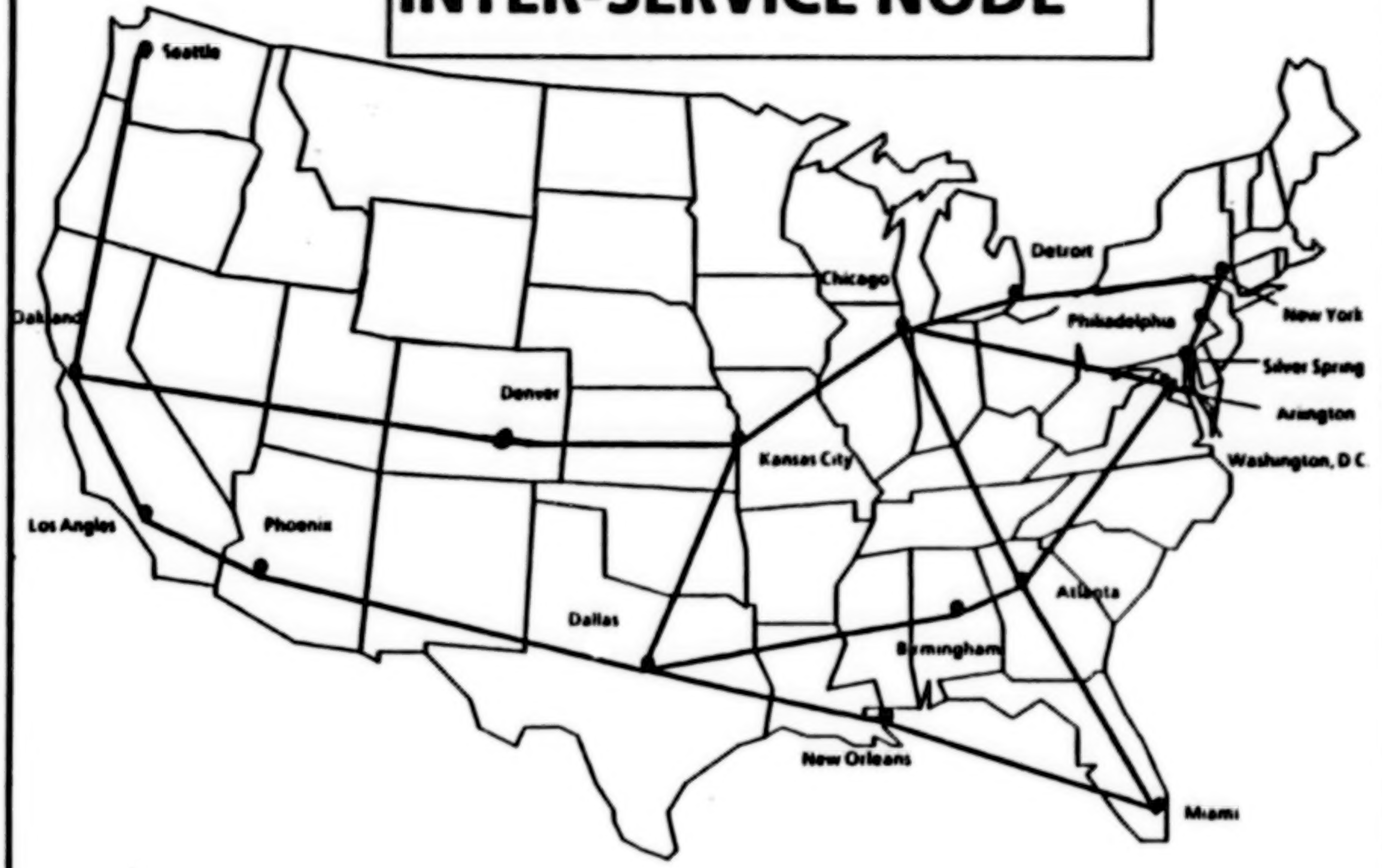
NETWORK A TOPOLOGY

INTER-SERVICE NODE


Seattle
Oakland
Denver
Kansas City
Chicago
Detroit
New York
Philadelphia
Silver Spring
Arlington
Washington, D.C.
Los Angles
Phoenix
Dallas
Atlanta
Birmingham
New Orleans
Miami

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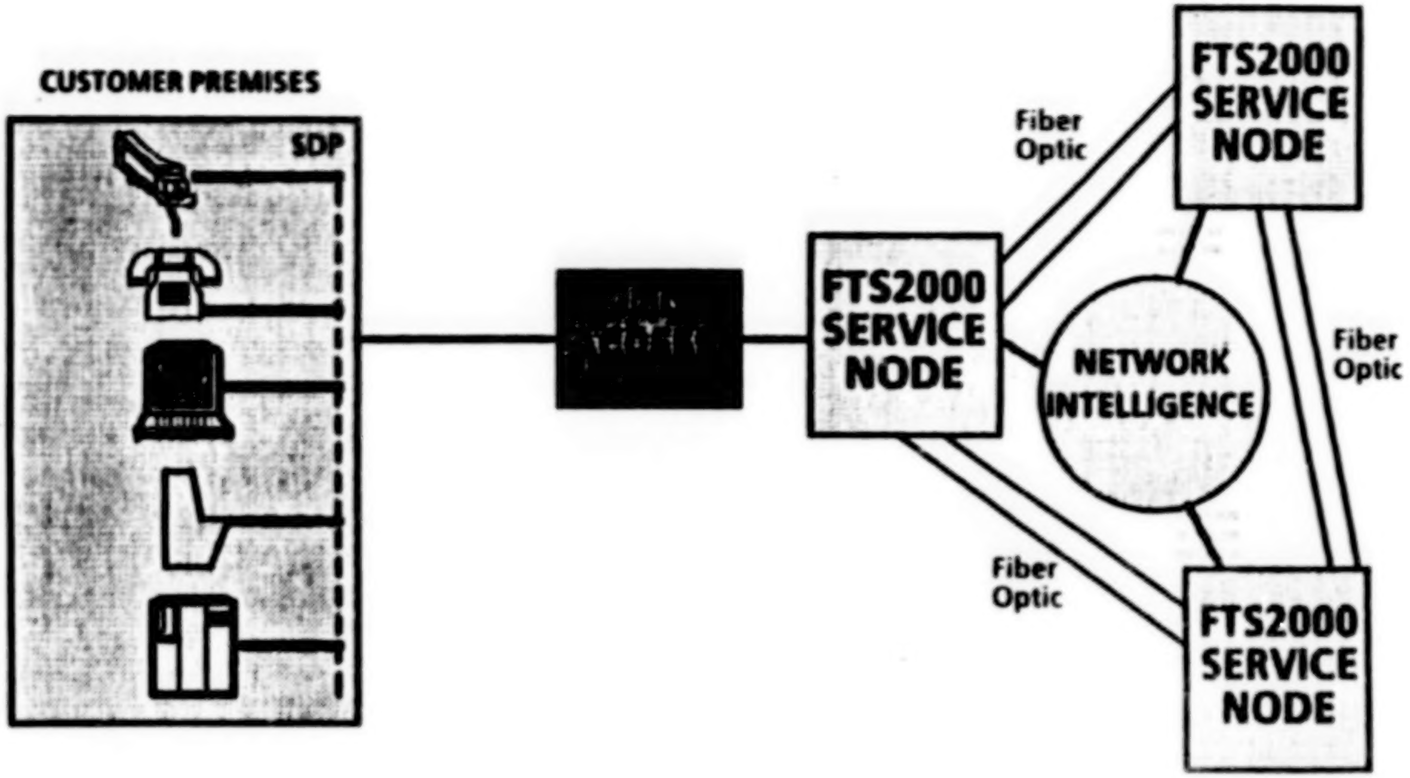
The Four Basic Element of the Architecture


CUSTOMER PREMISES
SDP
FTS2000 SERVICE NODE
Fiber Optic
FTS2000 SERVICE NODE
NETWORK INTELLIGENCE
Fiber Optic
Fiber Optic
FTS2000 SERVICE NODE

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FTS 2000 Time Line

1990

April—DOD agrees to use FTS 2000 services when possible but retains power to decide when network use is appropriate.

March—MCI protests FTS 2000's extension to non-government entities—specifically HHS' plan to use the network to link its Child Support Enforcement Network (CSEnet) to state agencies.

June 24—Transition of long-distance voice services from old FTS to FTS 2000 complete; 1.3 million users now served by the new system.

June 5—MCI protests to GAO the Bureau of Prisons' decision to use FTS 2000 for inmates' private phone calls.

April 12—GSA contracting officer Carol Hall rules the network can be used for HHS' CSEnet.

1989

May 26—Federal Communications Commission approves AT&T's tariff for FTS 2000.

Feb. 20—GSBCA and GSA dismiss MCI and Martin Marietta protests of award to AT&T.

Feb. 6—MCI goes to the GSA's Board of Contract Appeals and Martin Marietta to GSA to protest AT&T's award.

Oct. 7—Voice cutover to FTS 2000 begins.

March 20—GSA kills major telecommunications buys at Justice and Labor and amends or cancels a dozen other agency networks to enforce mandatory FTS 2000 use.

Feb. 13—GSA suspends funding for unawarded telecommunications projects at 18 agencies.

1988

Oct. 31—Michael Corrigan named deputy commissioner of IRMS at GSA for telecommunications, including FTS 2000.

August—Bernard J. Bennington, who has run the FTS 2000 procurement, leaves GSA for a one-year sabbatical at the National Science Foundation. IRMS commissioner Frank Carr takes over responsibility for FTS 2000.

March 14—GSA names members of an independent advisory committee to oversee bid evaluation.

Jan. 28—Amended RFP that provides for award to two primary vendors is issued.

Dec. 7—Contracts to provide FTS 2000 services awarded; AT&T gets 60 percent, US Sprint 40 percent.

Nov. 30—Contract for Technical Services and Maintenance in support of FTS 2000 awarded to Contel Federal Services Corp.

September—Congress makes use of FTS 2000 mandatory for executive-branch agencies.

April 29—Vendor proposals for FTS 2000 due.

February—EDS drops out of the running a second time. US Sprint, EDS' bid team partner, decides to continue in the competition as a prime contractor.

1987

December— Original contract award date.

Oct. 30—RFP revised to provide awards to two primary vendors.

June—Electronic Data Systems Corp., originally teamed with US Sprint, withdraws from the FTS 2000 race, leaving two teams—one led by AT&T Co. and the other by Martin Marietta Corp.

Nov. 30—EDS re-enters competition for FTS 2000.

Sept. 27—GSA, responding to pressure from Reps. Jack Brooks (D-Texas) and Glenn English (D-Okla.), agrees to award FTS 2000 to two prime contractors.

1986

Oct. 24—GSA publishes second draft RFP.

Dec. 31—GSA issues first RFP.

1985

Feb. 13—GSA holds first briefing for industry and press.

Oct. 11—GSA issues first draft request for proposals.

1984

GSA first announces intent to replace 21-year-old analog Federal Telecommunications System.

FCW WHITE PAPER August 20, 1990

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DEDICATED TRANSMISSION

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EQUIPMENT SUPPORTED

[illegible] supported by FTS2000's Switched Voice
and Dedicated Transmission [illegible]

- Telephones
- Personal Computers
- Terminals
- Mainframe Computers
- Facsimiles
- PBXs (analog and digital)

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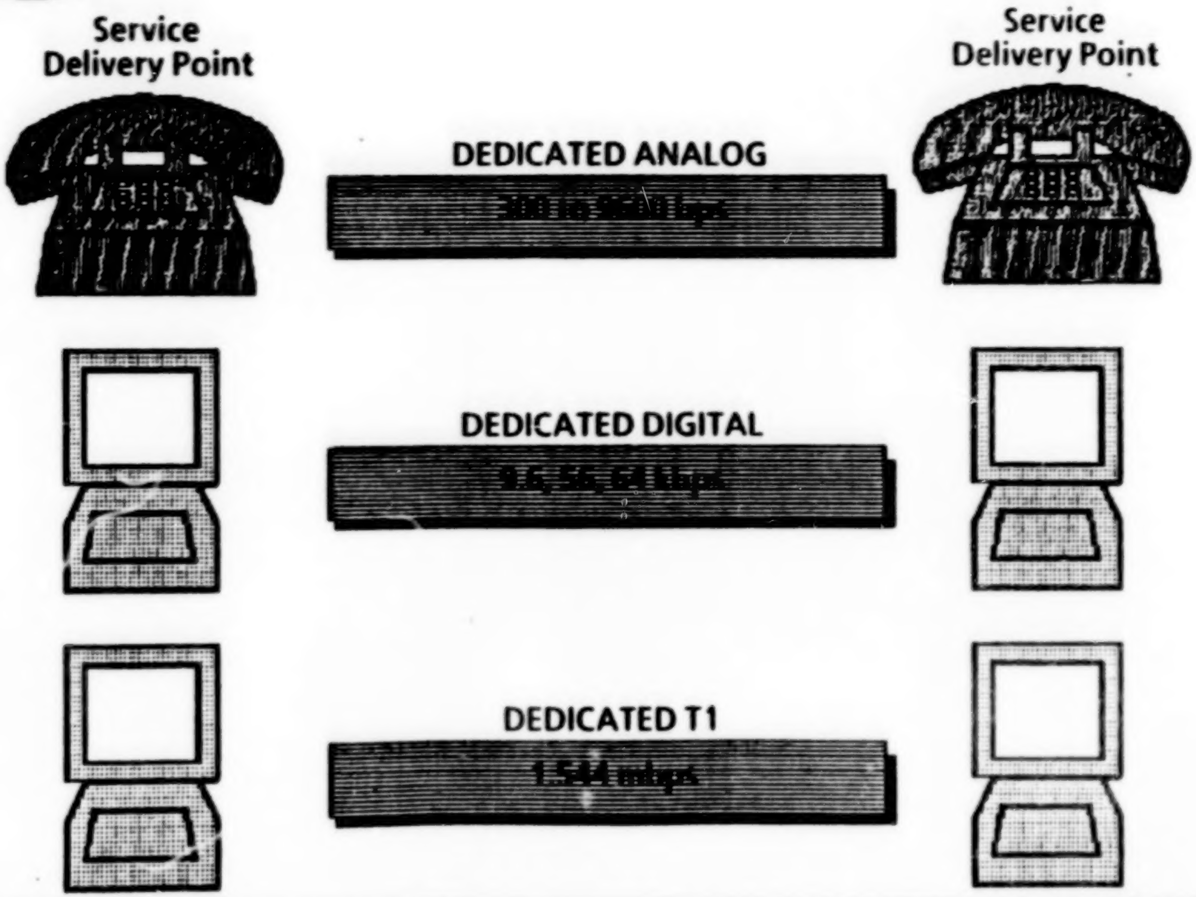
FTS2000

DEDICATED
TRANSMISSION

ACCESS ALTERNATIVES



Service
Delivery Point

Service
Delivery Point

DEDICATED ANALOG

300 to 9600 bps

DEDICATED DIGITAL

9.6, 56, 64 kbps

DEDICATED T1

1.544 mbps

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MultiNet TCP/IP
for
VAX/VMS
Update

L. Stuart Vance

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MultiNet TCP/IP for VAX/VMS Update

- Multi-protocol networking services (TCP/IP, CHAOSnet, PUP) for VAX/VMS computer systems
- Currently shipping ***MultiNet V2.2***
- Single kit for VMS V4.5 - V5.4
- All DEC supported VAX/VMS configurations

Device Support

Ethernet

- All Digital controllers
- CMC ENP family in link mode
- Excelan/Novell EXOS family (except BI board) in link mode
- Interlan NI1010
- Xerox 2.94 Mbps Ethernet

Other Technologies

- NSC Hyperchannel
- Shared Proteon proNET-10, 80
- X.25 - ACC 5250/6250
- T1/HDLC - ACC 5100/6100
- DMR-11, DMV-11 (IP over DDCMP)
- SLIP - using any VMS terminal line

DECnet Interoperability

- DECnet over IP; encapsulates DECnet datagrams in UDP datagrams (appears to DECnet as a point-to-point link between DMR-11 interfaces)
- IP over DECnet
  - Kernel implementation — transmits IP datagrams over a DECnet link in the networking kernel by calling NETDRIVER at the ALTSTART entry point
  - Dbridge
    - Transmits IP datagrams over a DECnet link via a user process using $QIO reads/writes
    - Interoperable with WIN/TCP and Fusion Dbridge implementations

Installation

- VMSINSTAL - painless
  - 99% of configurations supported
  - 15 minutes or less on most newer systems

- Configuration utilities
  - Handle all aspects of network configuration and operation
  - Perform sanity checks to ensure viable configuration
  - Automatically generate all startup command files
  - Utilities:
    - Network/devices
    - Remote printer queues
    - Services
    - DECnet over IP
    - Client and Server NFS

MultiNet Services

- Although servers may listen on their own for service requests, the Master Server provides an easier way of invoking services
- Inbound connection requests handled by Master Server (configured by the server configuration utility)
- Accepts or rejects connection; if it accepts, it either:
  - — Peforms the service internally, or
  - — Creates a server process and passes the connection on SYS$INPUT, SYS$OUTPUT, ...
- Can restrict access on source host or net address on a per-service basis
- Keep an audit trail of attempted, accepted, and rejected requests on a per-service basis
- Sites can provide locally written Auditing code
- Internal servers may be linked in or dynamically loaded from shareable images

Domain Name Server

- BIND 4.8.1 + Partial Asynchronous Zone Transfers
- Runs internal to Master Server
- NSLOOKUP provided
- If Domain Name System (DNS) query fails, or DNS not enabled, lookups use host tables compiled using a perfect hashing scheme

Routing Protocols

- GATED 1.9.1.7
- Runs internal to Master Server
- Supports RIP, EGP, HELLO

Telnet

- Direct connection between VMS terminal driver and network kernel
  - Overhead about the same as a DZ-11
  - No process involved, so no context switching
- Virtual terminals supported
- Negotiations
  - Terminal type (SMG)
  - Window size
  - Baud rate
  - Flow control (negotiated local by default)
  - TN3270 automatic recognition
- No inherent limit on number of incoming connections; customer running with 150 connections into a VAX 6230
- Optional switches to bypass newer option negotiation features for compatibility with other broken Telnet implementations (antique-mode)

FTP

- Hybrid server
  - Initially runs internal to Master Server
  - When USER and PASS are received, LOGINOUT is invoked to validate, initialize, and run the FTP server process
- Supports all VMS security features:
  - ACLs (not just UIC ACLs)
  - Accounting
  - Auditing
  - Breakin detection and evasion
  - Security alarms
- Runs SYLOGIN.COM, LOGIN.COM
- Creates FTP_SERVER.LOG file in login directory with log of transactions
- STRU O VMS
  - Transparent VMS-VMS transfer of all VMS file types
  - Automatically negotiated
  - Fast, no reformatting needed
- Record structure also supported
- Performance:
  - MicroVAX II can saturate DEC Ethernet interfaces

SMTP

- Uses VMS Mail foreign protocol interface: SMTP%"user@node"
- Enqueueing done with VMS server queue (using VMS queue management)
- MX support
- Tries all IP address found via "A" records until successful
- Incoming and outgoing mail enqueued (allows incoming mail to be forwarded to an unavailable DECnet node)
- MM-32 user interface bundled with ***MultiNet***
- VMS Mail SET FORWARD and SET PERSONAL-NAME supported
- Supports outbound cluster (or organizational) alias
- PMDF supported as alternative (fully functional email gateway)

DECwindows over TCP/IP

- DECwindows over TCP/IP support provided by emulation of the VMS/ULTRIX Connection (UCX) $QIO interface
- Looked into using DECwindows transport layer interface, but decided to do UCX $QIO emulation as a more general solution (to support other applications written to run over UCX)

BSD "r" Services

- RLOGIN — remote terminal protocol
- RSHELL/REXEC — remote command execution
- RCP — remote copy protocol
- RMT — remote access to VMS tape drives
- Each uses "r" services autherntication
  (HOSTS.EQUIV and .RHOSTS)

Remote Printing

- LPD protocol client and server
  - — Integrated with VMS queueing system
  - — UNIX machines can print on VMS printers
  - — VMS systems can print on UNIX printers via a VMS print queue (symbiont and spooled pseudo-device)
- Stream-mode symbiont sends print jobs directly to remote TCP port (useful for printers connected to terminal servers)
- Controlled by printer configuration utility
- Supports VMS accounting
- User definable */etc/printcap* to VMS print queue attribute mapping

RPC Services and NFS Server

- Full UNIX filesystem semantics mapped to VMS filesystem
- Respects VMS diskquotas
- VMS text files are converted to UNIX stream format for access from NFS clients
- Cache to mask VMS bottlenecks
- Supports all ODS-2 VMS volumes:
  - — Shadow sets
  - — Bound volumes
  - — DFS served disks
- Very high performance
  - — Multi-threaded so performance not degraded by multiple clients
  - — Runs in the kernel, so no process context overhead involved
  - — Uses a special XDR serializer

NFS Client

- Transparent file access to NFS servers from VAX/VMS systems
- Emulates Files-11 ODS-2 XQP, presenting virtually all of the VMS file system semantics
- Supports arbitrary RMS file/record types with text files mapped to RMS Stream_LF record type
- Performance, even with majority of code in process for debugging, is good (within a factor of 3 of a local disk)

NETCONTROL

- Allows privileged users to control servers running internal to the Master Server
- Can be used to control both local and remote machines (using ***MultiNet*** security features)
- MULTINET NETCONTROL /HOST=TGV.COM NFS RESTART

Diagnostics

- PING – uses ICMP packets to determine reachability, packet loss, round trip timing
- TRACEROUTE – trace route of a host through an IP network
- TCPDUMP – Ethernet protocol analysis

Programming Support

- Shareable 4.3BSD UNIX compatible socket library
- Programmer's kit separately installed (MNETLIB)
- Hardcopy Programmer's Guide and extensive online HELP information
- MultiNet $QIO (compatible with WIN/TCP), EXOS compatible $QIO, and UCX compatible $QIO interfaces supported
- RPC programming library

Miscellaneous Features

- FINGER
- WHOIS client
- NETSTAT
- SYSTAT
- TFTP
- BOOTP
- RARP
- NTP
- TALK/NTALK
- BBOARD
- RUSERS
- RWALL
- REMIND
- CHARGEN
- DAYTIME
- TIME
- DISCARD
- ECHO
- RPCQUOTA

MultiNet Futures

- Kerberos
  - ticket server
  - klist
  - kinit
  - kdestroy
  - Kerberized Telnet and FTP
- ALL-IN-1/Message Router to SMTP gateway capability
- VMS NFS Client to VMS NFS Server support
- Performance enhancements in NFS Client and Server

MultiNet Futures

- Support for booting diskless Sun workstations and DECstations
- Full support for VAX-11 C runtime socket library (run UCX applications unmodified over ***MultiNet***)
- GATED V2.0 - EGP, RIP, HELLO, BGP
- BIND 4.8.3
- POP2 Mail Server (possibly more)

MultiNet Futures

- select() supported in ***MultiNet*** socket library
- ISODE — OSI applications over TCP/IP
- XVIEW toolkit and OPEN LOOK Window Manager under VAX/VMS and DECwindows
- SNMP network management station under VAX/VMS
- Command line recall and editing ! ! !

D. Science Networking Keynotes

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Science Network Resources: Distributed Systems

Neal Cline
February 13, 1991

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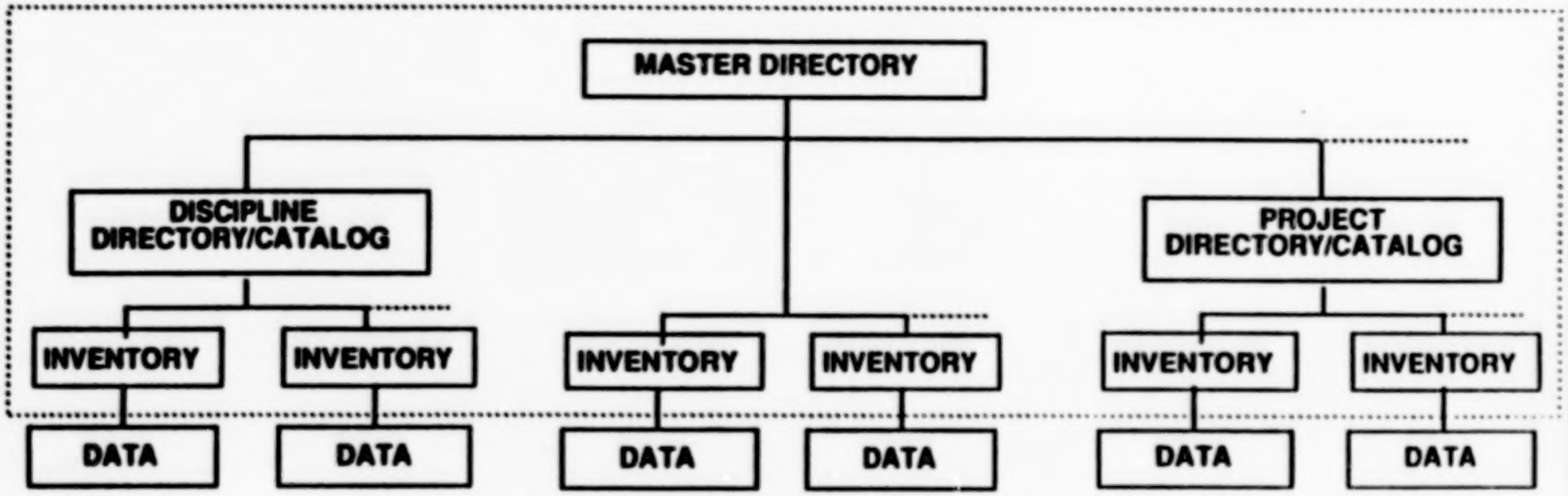
DATA SYSTEM ENVIRONMENT



MASTER DIRECTORY

DISCIPLINE DIRECTORY/CATALOG

PROJECT DIRECTORY/CATALOG

INVENTORY

INVENTORY

INVENTORY

INVENTORY

INVENTORY

INVENTORY

DATA

DATA

DATA

DATA

DATA

DATA

Directory - Brief overview information about whole data sets

Catalog - More detailed information about whole data sets

Inventory - Information about individual granules or elements of the data set

WHAT IS A PROTOTYPE INTERNATIONAL DIRECTORY?

PURPOSE

- **An online information system for rapid and efficient identification, location, and overview information on data sets of interest to the science community**
- **Initial place to search for data - leading to catalogs and inventories having more detailed information about the data**
- **Automated network links to other systems having more detailed information and possible additional capabilities**

FEATURES

- **No training needed**
- **Open, free access**
- **Interdisciplinary**
- **Earth and space science data**
- **International**
- **Data center/archive descriptions**
- **Campaign/project descriptions**

MASTER DIRECTORY

ADVANTAGES OF ON-LINE DIRECTORIES

- Provides data information to the science community 24 hours per day
- Contains up-to-date information on the well-known data as well as the lesser-known data sets in remote locations
- Allows quick information sharing among the interconnected directories via Directory Interchange Format (DIF) files
- Permits immediate links to other on-line information systems which provide more detailed information
- Information can be periodically extracted onto CD-ROM or floppy disk format for use in personal computer systems

MASTER DIRECTORY

INTERCONNECTED DIRECTORY ASSUMPTIONS

- Directory service will be provided free of charge to the science community

- The DIF files will be used as the standard of directory information exchange

- DIF files submitted to one node will be distributed, through an established procedure, to all nodes of a directory system

- DIF files will be reviewed at procedurally-determined locations according to standards defined for the system

- Copies of the final, reviewed DIF entry are retained at the reviewing location and by the DIF author. The author copy is the master copy.

MASTER DIRECTORY

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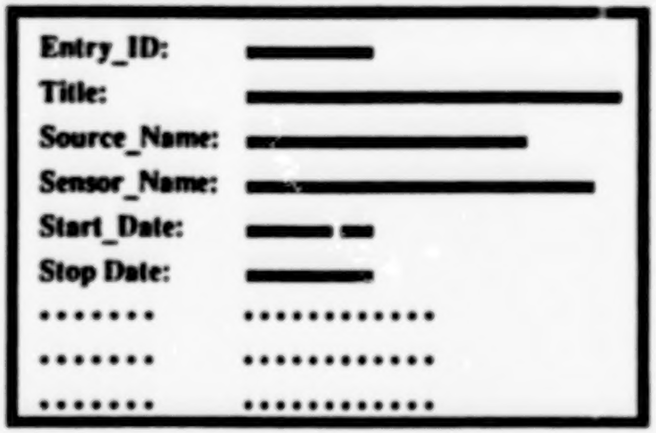
DIF - EXCHANGE FILE FOR DIRECTORY INFORMATION

Description of a data set is written in the Directory Interchange Format (DIF) then passed among directories and automatically loaded



Entry_ID:
Title:
Source_Name:
Sensor_Name:
Start_Date:
Stop Date:
....
....
....

DIF :

- A standard developed by Catalog Interoperability Working Group (federal agency and academic representatives)
- Simple ASCII text file
- Usually 2-3 typed pages in length
- In use by federal agencies, academia, European countries, Japan, Russia
- Described in DIF Manual (contact Jim Thieman)
- Maintained under change control

DIRECTORY INTERCHANGE FORMAT

- **SPECIFIES SYNTAX STANDARDS [PARAMETER: VALUE]**
- **SPECIFIES THE PARAMETERS CONSTITUTING A MASTER DIRECTORY ENTRY:**
  - TITLE
  - START AND STOP DATA
  - SENSOR
  - SOURCE
  - INVESTIGATOR AND TECHNICAL CONTACT
  - DATA CENTER
  - CAMPAIGN OR PROJECT
  - STORAGE MEDIUM
  - PARAMETER MEASURED
  - DISCIPLINE KEYWORDS
  - SPATIAL COVERAGE
  - LOCATION KEYWORDS
  - GENERAL KEYWORDS
  - REFERENCES
  - SUMMARY

MASTER DIRECTORY

INFORMATION CONTENT OF DIF AND DIRECTORIES

Descriptive Title
Brief Summary/Abstract
Data Source Name (Spacecraft, Platform, etc.)
Sensor Name
Start/Stop Date
Storage Medium
Discipline/Subdiscipline
Parameters Measured
Location Name
Latitude/Longitude Coverage
Bibliographic References
Name, Address, Phone, etc. for:
    Investigator
    Technical Contact
    Data Center Contact
Data Center Name
Quality

MASTER DIRECTORY

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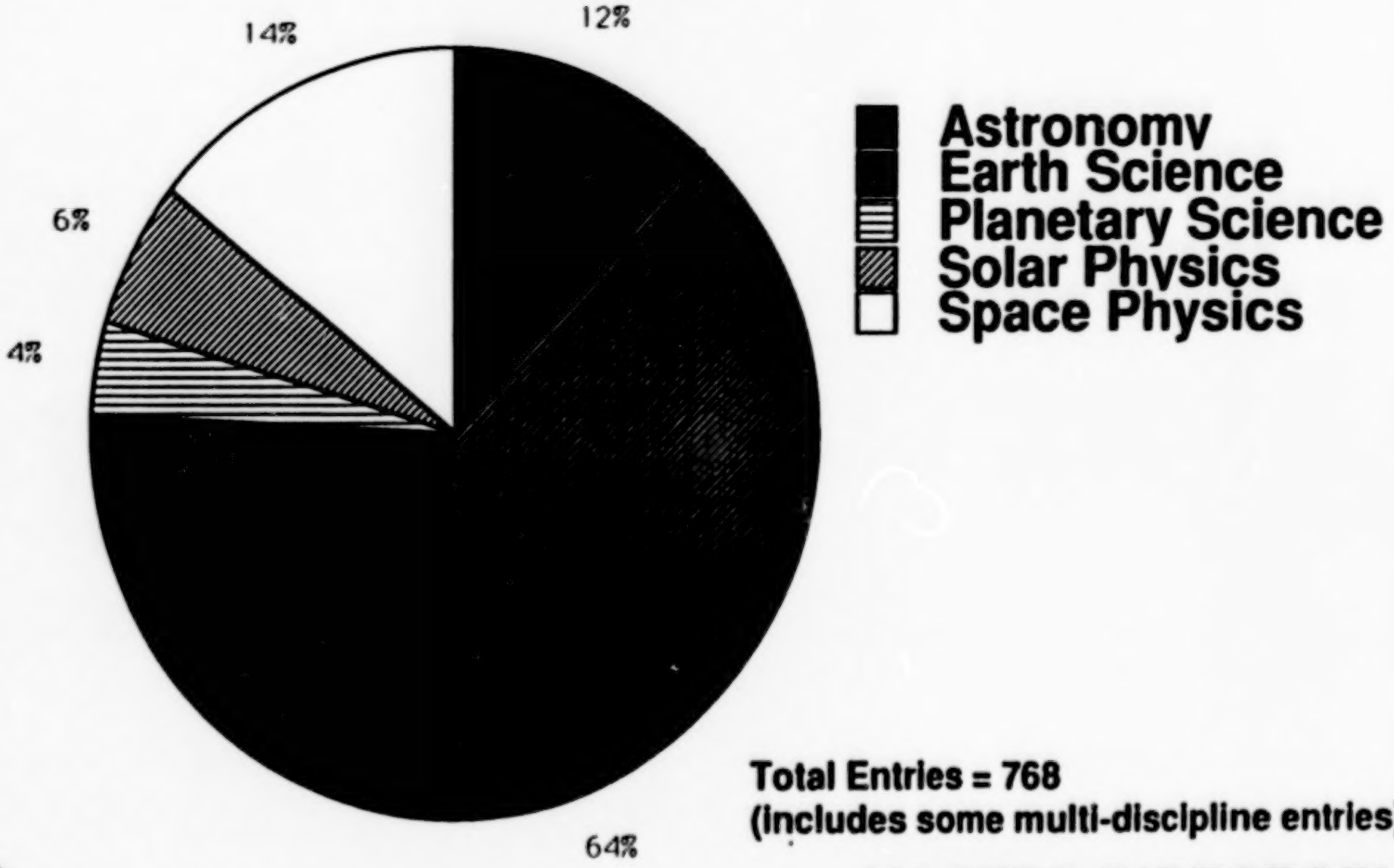
DIRECTORY POPULATION STATUS

Percentage of Directory Entries by Discipline
January, 1990



Total Entries = 768
(includes some multi-discipline entries)

MASTER DIRECTORY

DIRECTORY INTERCONNECTIONS STATUS AT GSFC

PRESENT

ADC - Astronomical Data Center
EDC - EROS Data Center Data Ordering Mailbox
IUE FACILITIES - IUE Processing Facilities
LEDA - ESA Land Observations Data Inventory
NCDS - NASA Climate Data System
NODS - NASA Ocean Data System
NSSDC - NSSDC Data Ordering Mailbox
OMNI - Interplanetary Medium Database
OCEANIC - Ocean Network Information Center
PDS - Planetary Data System
PLDS - Pilot Land Data System
SDCS - SAR Data Catalog System
TOMS - NIMBUS-7 Total Ozone Mapping Spectrometer Data
Assorted Dynamics Explorer Data Set Catalogs

Note that there are approximately 40 data systems/centers now described in the directory. The ones above can be connected to automatically from the directory through the LINK command.

MASTER DIRECTORY

DIRECTORY INTERCONNECTIONS STATUS (CONT.)

FUTURE

BRUNET REQUEST - UCLA Space Physics Data System

CEOS PID - CEOS Prototype International Directory System (Europe, Japan)

IRPS - Image Retrieval and Processing System (Washington Univ.)

NASA ARIN - NASA Aerospace Research Information Network

NASA GISS - NASA Goddard Institute of Space Studies

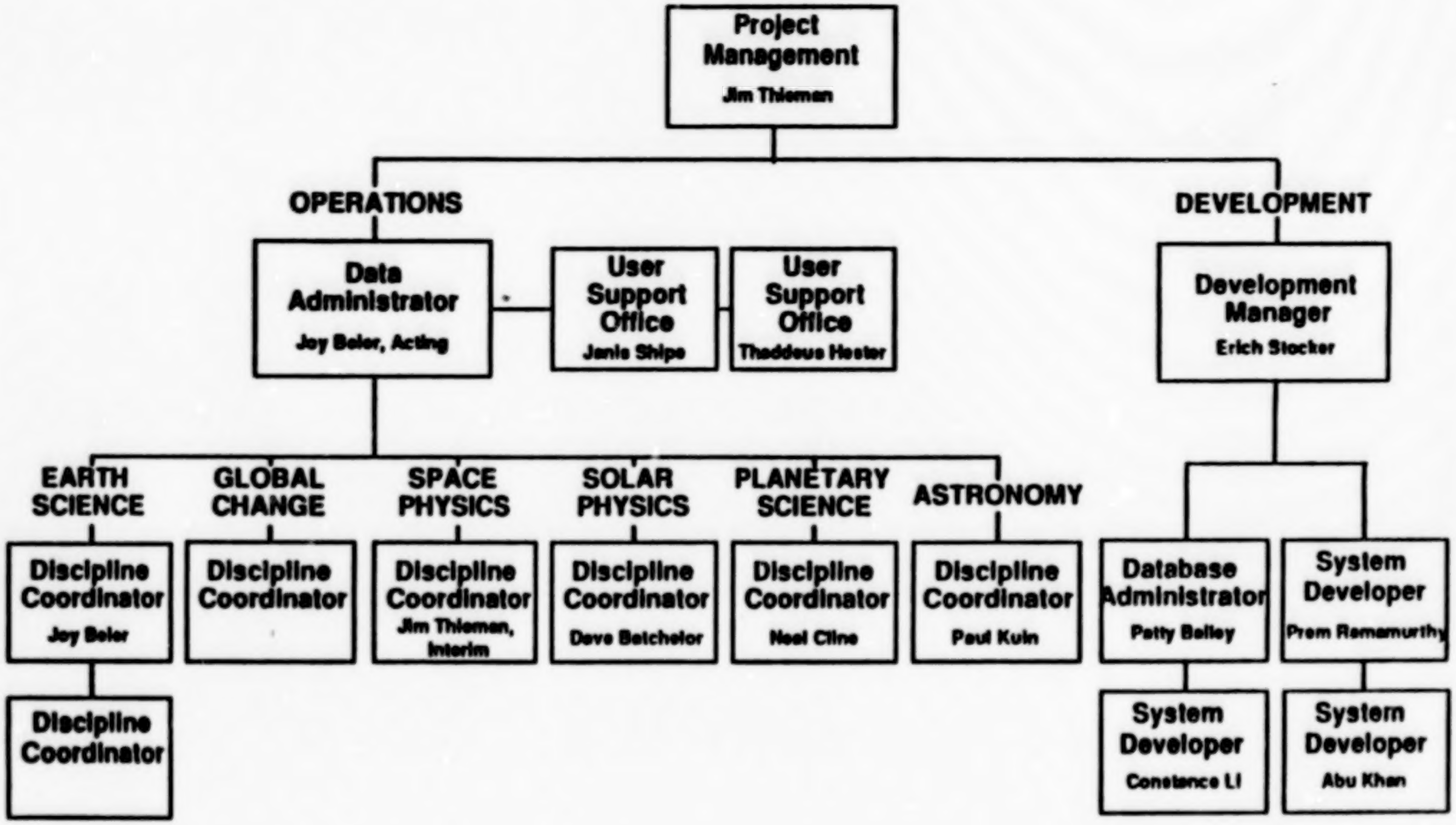
NASA RECON - NASA REmote CONsole - (NASA Scientific and Technical Information Database)

NOAA NESDD - NOAA Earth Systems Data Directory

UA - GEODATA CENTER - University of Alaska Fairbanks/GeoData Center

USGS ESDD - USGS Earth Science Data Directory

DIRECTORY STAFFING AT GSFC



Project Management
Jim Thieman

OPERATIONS

Data Administrator
Joy Beier, Acting

User Support Office
Janis Shipe

User Support Office
Thaddeus Hester

EARTH SCIENCE
Discipline Coordinator
Joy Beier

Discipline Coordinator

GLOBAL CHANGE
Discipline Coordinator

SPACE PHYSICS
Discipline Coordinator
Jim Thieman, Interim

SOLAR PHYSICS
Discipline Coordinator
Dave Batchelor

PLANETARY SCIENCE
Discipline Coordinator
Neal Cline

ASTRONOMY
Discipline Coordinator
Paul Kuin

DEVELOPMENT

Development Manager
Erich Stocker

Database Administrator
Patty Bailey

System Developer
Constance Li

System Developer
Prem Ramamurthy

System Developer
Abu Khan

The number of staff reflects the role of GSFC as a coordination point for software and database content. (Not all personnel are full-time)

MASTER DIRECTORY

ACCESS TO DIRECTORY AT GSFC

SPAN

$ SET HOST NSSDCA
USERNAME: **NSSDC**

INTERNET

TELNET 128.183.10.4
USERNAME: **NSSDC**

OMNET

GOTO NSSDC

DIAL-IN LINES

Dial 301-286-9000
CONNECT 1200 (or 2400 or 300)
Enter several carriage returns
ENTER NUMBER
MD
CALLING 55201 (or 55202)
CALL COMPLETE
Enter several carriage returns
USERNAME: **NSSDC**

ITALICS INDICATE RESPONSE FROM THE COMPUTER

MASTER DIRECTORY

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OVERVIEW of the NASA ASTROPHYSICS DATA SYSTEM

a presentation to the

NASA NSI

USERS WORKING GROUP MEETING

R. B. POMPHREY

13 FEBRUARY 1991

OVERVIEW of the ADS
AGENDA

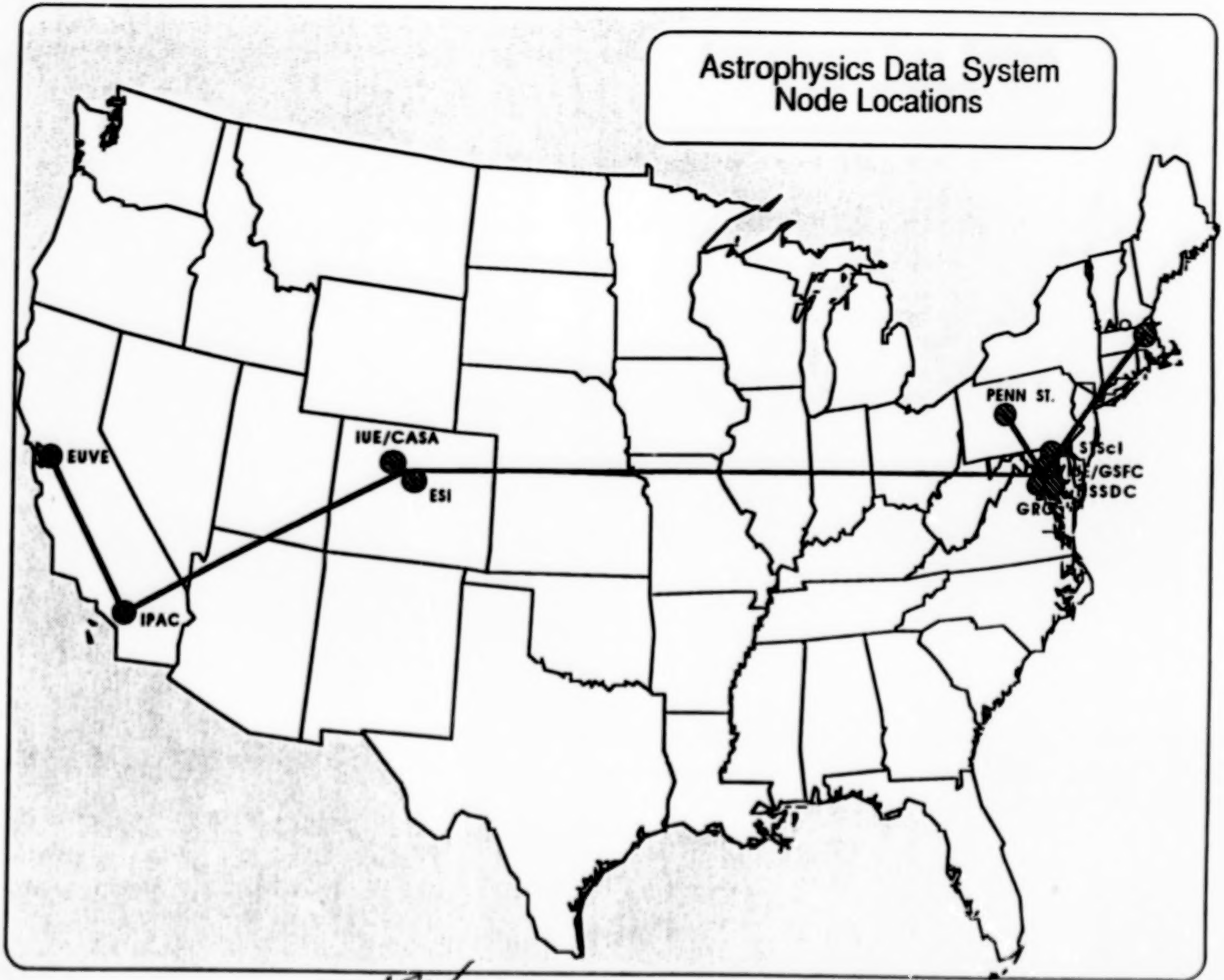
- The Problem
- The ADS Project
- Architectural Approaches
- Elements of the Solution
- Status of the Effort
- The Future

OVERVIEW of the ADS

The Problem

- Drinking from the Fire Hose
- Multi-Spectral Research
- Real-time Observing / Coordinated Observations
- "Data about Data" and Tapping Human Expertise
- Collaboration

Astrophysics Data System Node Locations


EUVE
IPAC
IUE/CASA
ESI
PENN ST.
SAO
STScI
E/GSFC
SSDC
GR

ADS OVERVIEW
THE ADS PROJECT

NASA ASTROPHYSICS DIVISION PROGRAM

DR. GUENTER RIEGLER -- MISSION OPERATIONS BRANCH CHIEF

DR. FRANK GIOVANE -- ADS PROGRAMS MANAGER

ASTROPHYSICS DATA SYSTEM PROJECT

DR. JOHN GOOD -- PROJECT MANAGER

DR. STEPHEN MURRAY -- PROJECT SCIENTIEST

DR. JOHN NOUSEK -- USER COMMITTEE CHAIR

ELLERY SYSTEMS, INC. -- SYSTEMS INTEGRATION

ADS OVERVIEW

THE ADS PROJECT - continued

CHARTER

To Provide current and future generations of space scientists with direct, on-line access to existing and future multispectral data and analysis tools.

OBJECTIVE

The ADS is a production level distributed processing system. The Objective of the ADS is to make all science data holdings and all ADS Hardware and Software services available to all users transparently.

OVERVIEW of the ADS

Architectural Approaches

- The "rlogin" model
  - User accesses each site independently
  - User must have accounts everywhere
  - Tools and interfaces are generally site specific
  - Data Transfer is done in a different environment

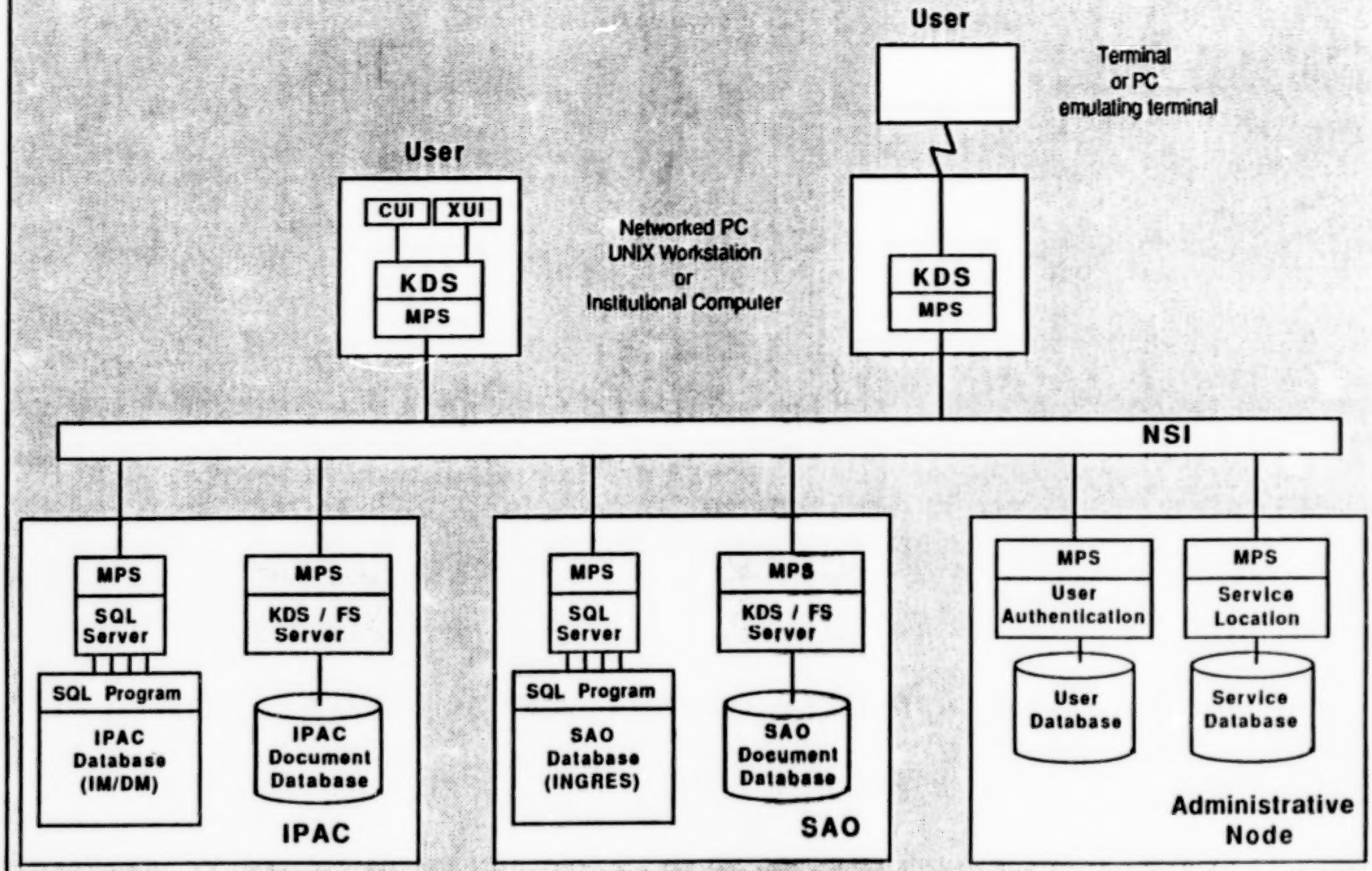
- The Client / Server Model
  - Global Uniformity
  - Standard Interfaces
  - Modularity
  - Separation of Processing and User Interface
  - Easily incorporates existing services
  - Easily expanded and evolved
  - Location independence (of user, data, and processing tools)

OVERVIEW of the ADS

Elements of the Solution

- User Interfaces
- User Services
  - Distributed Access to Existing Database Systems
  - Document Location and Retrieval
  - Local Table Manipulation
  - Local Visualization
- System Services
  - User / Service Authentication
  - Help
- Glue
  - NASA Science Internet
  - Message Passing Service
  - Standard Data Formats and I/O

ASTROPHYSICS DATA SYSTEM



User

Terminal
or PC
emulating terminal

User

CUI

XUI

KDS

MPS

Networked PC
UNIX Workstation
or
Institutional Computer

KDS

MPS

NSI

MPS

SQL Server

SQL Program

IPAC Database (IM/DM)

MPS

KDS / FS Server

IPAC Document Database

IPAC

MPS

SQL Server

SQL Program

SAO Database (INGRES)

MPS

KDS / FS Server

SAO Document Database

SAO

MPS

User Authentication

User Database

MPS

Service Location

Service Database

Administrative Node

1/31/91

ADS OVERVIEW

ELEMENTS OF THE SOLUTION - SQL SERVER

- Heterogeneous DBMS's
  - Relational
  - Heirarchical
  - Network
- Distributed Interaction
- Homogenization and Translation

ADS OVERVIEW

ELEMENTS OF THE SOLUTION - FACTOR SPACE

- Failure of the "Library" Model
- Personal Perspective
- Fields and Terms
- Factor Spaces

ADS OVERVIEW

DEVELOPMENT AND OPERATIONS PHILOSOPHY

The ADS was designed and built by practicing astrophysicists for practicing astrophysicists.

Utilizing the most advanced commercially available and supported distributed processing system technology, it is specifically designed to meet the evolving needs of the professional scientist and to provide the community with a powerful and immediately useful research and educational facility.

ADS OVERVIEW

STATUS

PHASE ONE:

At present, data holdings from SAO and IPAC are accessible using advanced remote procedure call and other advanced distributed processing system techniques. Over the next three months, data holdings from IUE/GSFC, IUE/CASA, STScI, Penn State, and the NSSDC will be added to the system. Data holdings from all great observatory and explorer class missions will be added as available.

PHASE TWO:

Provide on-line access to existing and future data analysis and manipulation tools to include imaging/visualization, graphic analysis, statistical, and such other tools as deemed appropriate by the user community. These tools will be made available as distributed processed to maximize compute and software resource availability to the community.

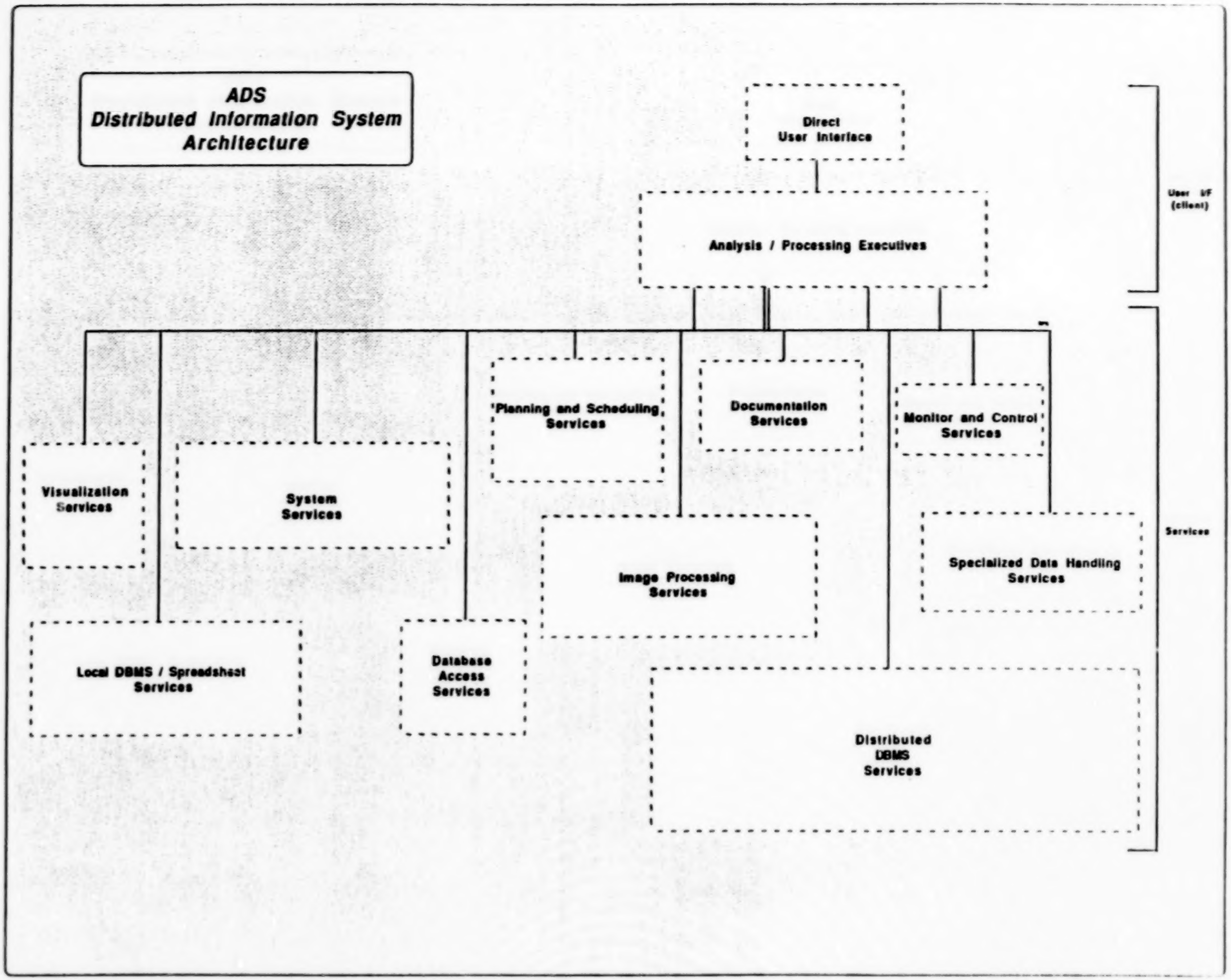
ADS OVERVIEW
THE FUTURE

- System Generated Services
    - Transaction Management
    - System Monitoring
    - System Interfaces
    - User Interfaces
    - Communications Services

- User Generated Services
    - Data Analysis
    - Visualization
    - Modeling

ADS OVERVIEW
THE FUTURE - continued

- Project Generated Services
    - Planning and Scheduling
    - Monitor and Control
- Datasets
    - Images
    - Spectra
    - Ground - Based Data
    - Textbooks and Journals



ADS Distributed Information System Architecture

Direct User Interface
Analysis / Processing Executives
User I/F (client)
Planning and Scheduling Services
Documentation Services
Monitor and Control Services
Visualization Services
System Services
Image Processing Services
Specialized Data Handling Services
Services
Local DBMS / Spreadsheet Services
Database Access Services
Distributed DBMS Services

ASTROPHYSICS DATA SYSTEM
FUNCTIONAL ARCHITECTURE

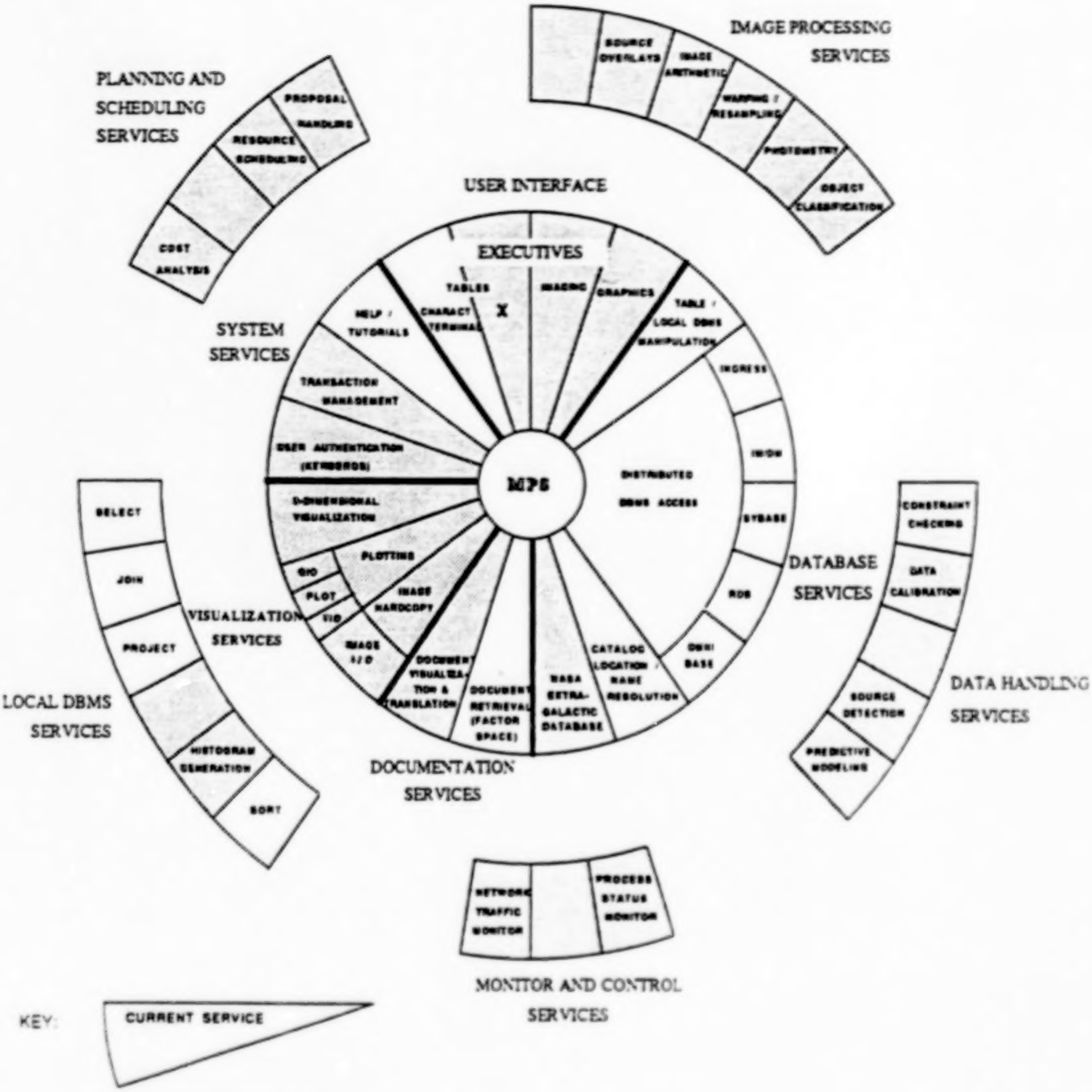


IMAGE PROCESSING SERVICES
SOURCE OVERLAYS
IMAGE ARITHMETIC
WARPING / RESAMPLING
PHOTOMETRY
OBJECT CLASSIFICATION
PLANNING AND SCHEDULING SERVICES
PROPOSAL HANDLING
RESOURCE SCHEDULING
COST ANALYSIS
USER INTERFACE
EXECUTIVES
TABLES
CHARACT TERMINAL
X
IMAGING
GRAPHICS
TABLE / LOCAL DBMS MANIPULATION
SYSTEM SERVICES
HELP / TUTORIALS
TRANSACTION MANAGEMENT
USER AUTHENTICATION (KERBEROS)
MPS
DISTRIBUTED DBMS ACCESS
INGRESS
IMDM
SYBASE
RDB
DBMI BASE
CATALOG LOCATION / NAME RESOLUTION
NASA EXTRA-GALACTIC DATABASE
DOCUMENT RETRIEVAL (FACTOR SPACE)
DOCUMENT VISUALIZA-TION & TRANSLATION
IMAGE I/O
IMAGE HARDCOPY
PLOTTING
GIO
PLOT
TID
3-DIMENSIONAL VISUALIZATION
VISUALIZATION SERVICES
DATABASE SERVICES
CONSTRAINT CHECKING
DATA CALIBRATION
SOURCE DETECTION
PREDICTIVE MODELING
DATA HANDLING SERVICES
SELECT
JOIN
PROJECT
HISTOGRAM GENERATION
SORT
LOCAL DBMS SERVICES
DOCUMENTATION SERVICES
NETWORK TRAFFIC MONITOR
PROCESS STATUS MONITOR
MONITOR AND CONTROL SERVICES
KEY:
CURRENT SERVICE
FUTURE SERVICE

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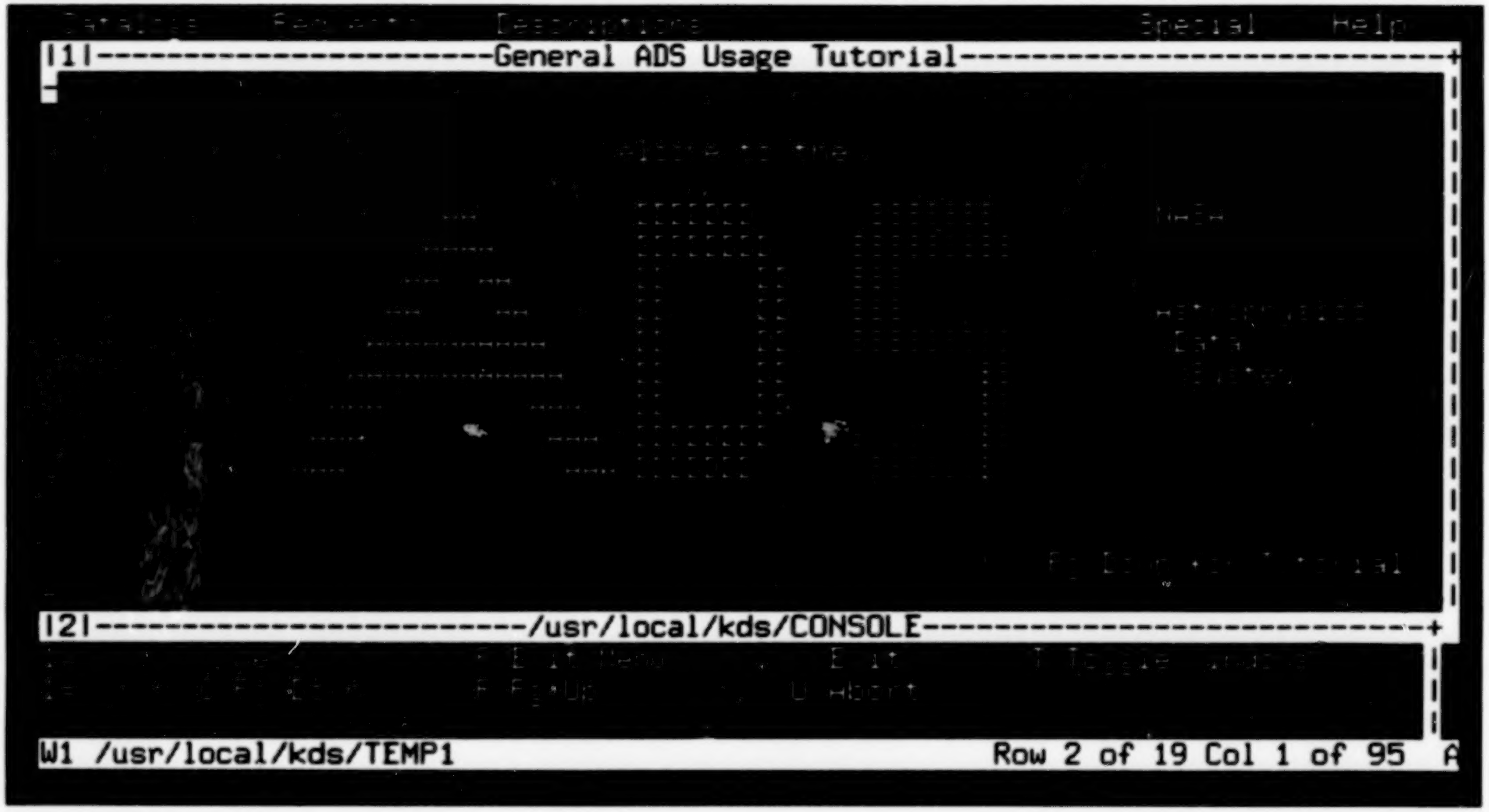
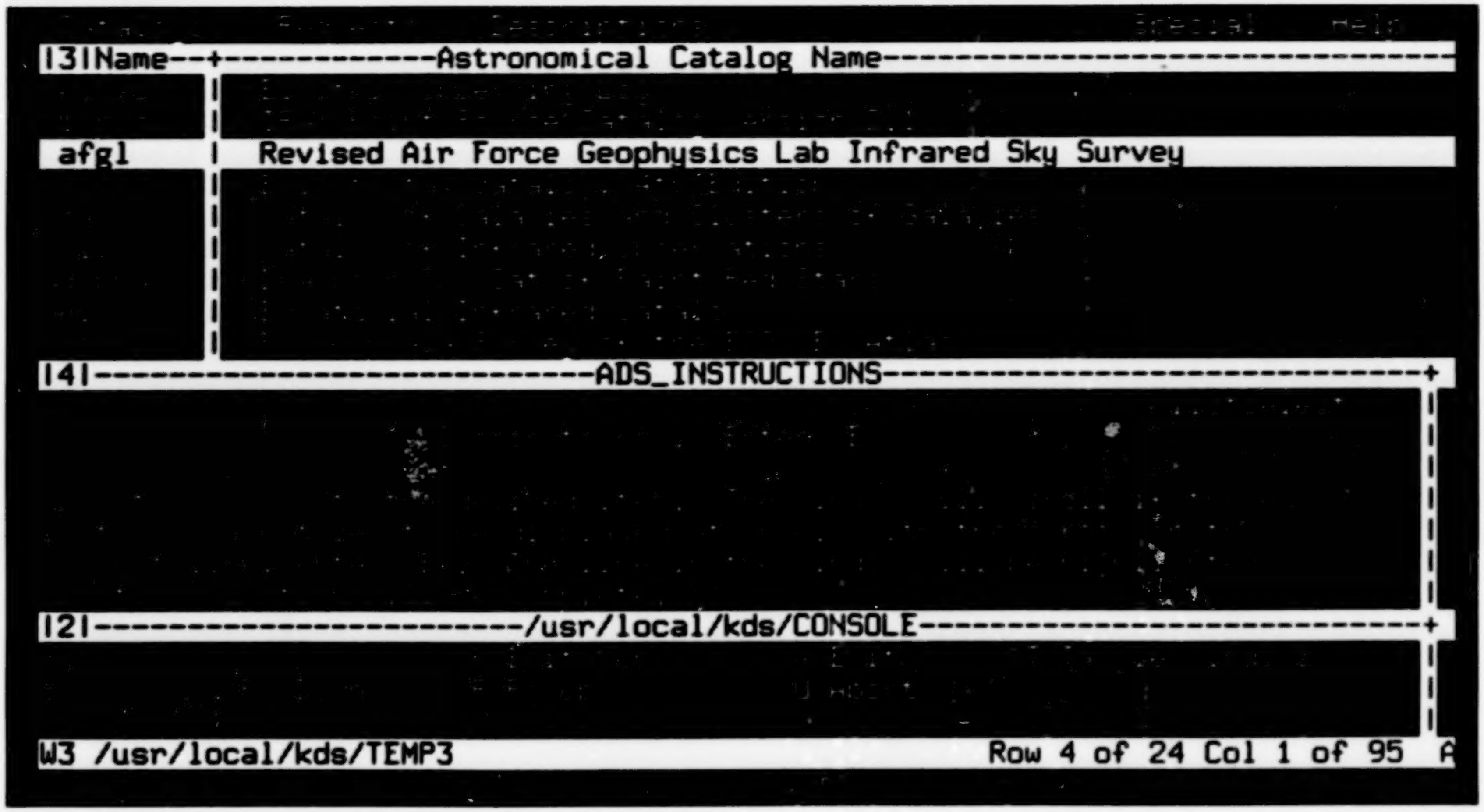
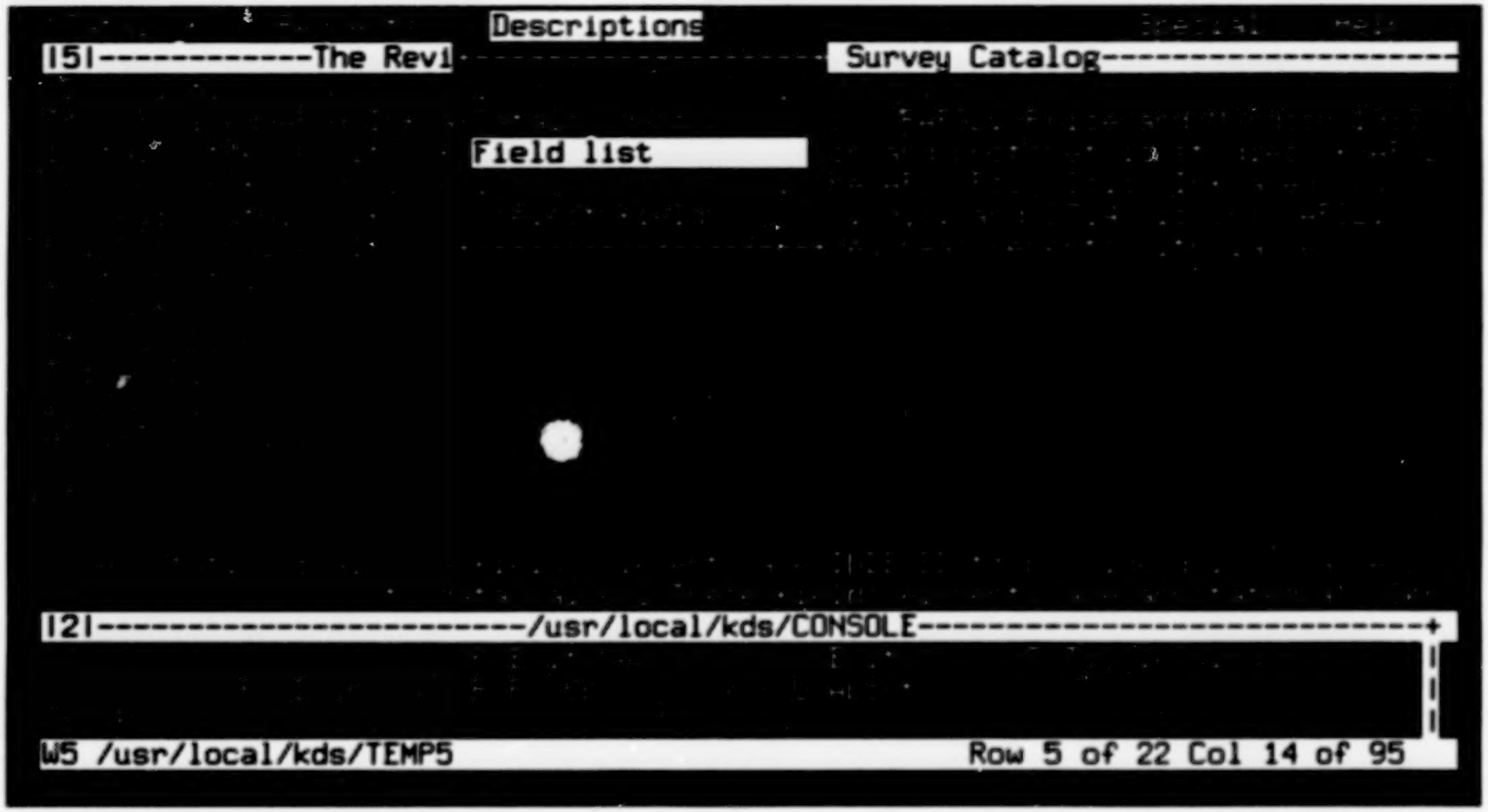
PAGE


Catalogs
Requests
Descriptions
Special
Help
Welcome to the
ADS
NASA
Astrophysics
Data
System
Exit
Abort

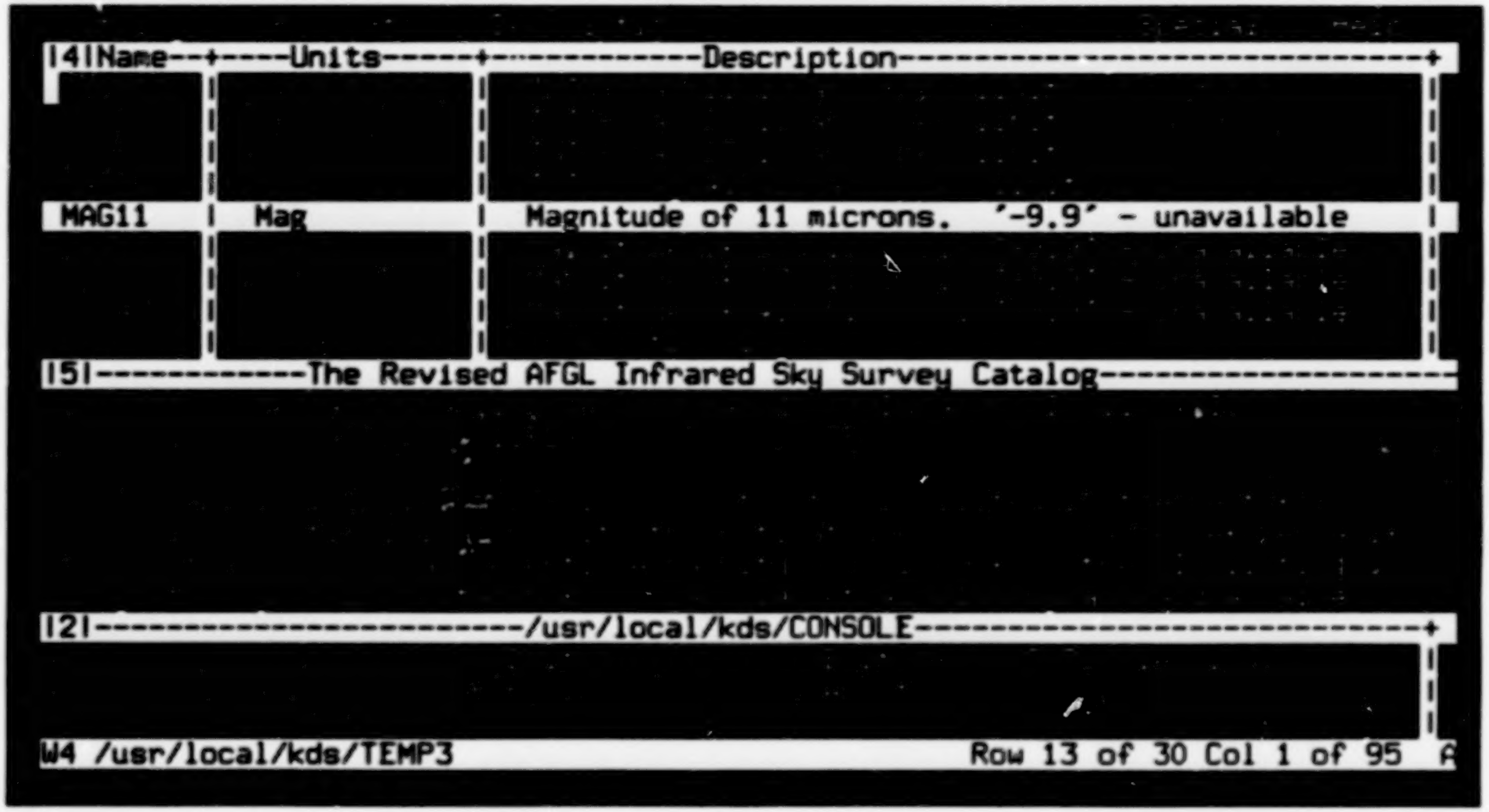
```
|1|----------------------General ADS Usage Tutorial--------------------------------+
|2|----------------------/usr/local/kds/CONSOLE----------------------------------+
W1 /usr/local/kds/TEMP1                                  Row 2 of 19 Col 1 of 95  A
```



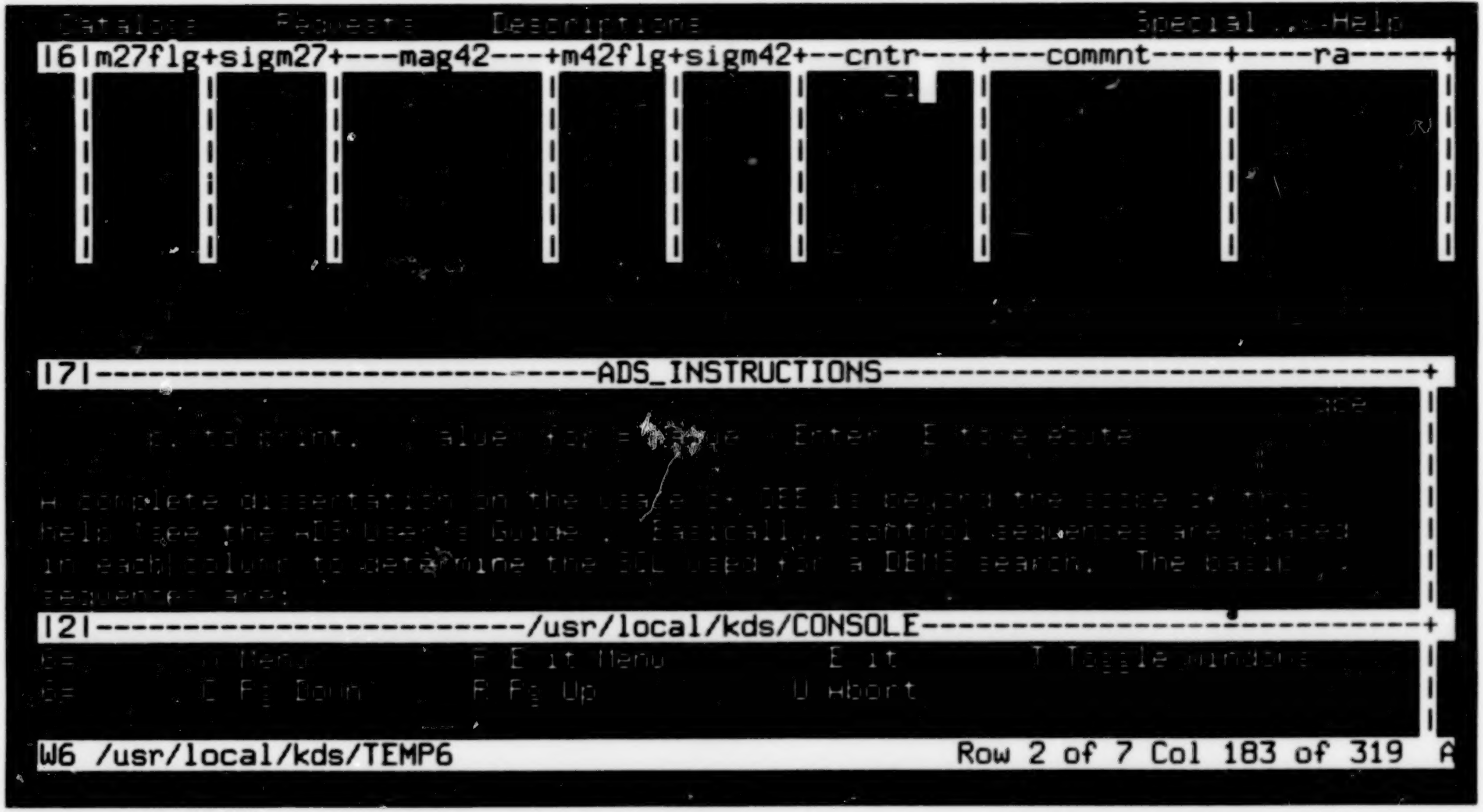
```
|3|Name--+-----------Astronomical Catalog Name-----------------------------------
 afgl    |  Revised Air Force Geophysics Lab Infrared Sky Survey
|4|--------------------------ADS_INSTRUCTIONS-------------------------------+
|2|----------------------/usr/local/kds/CONSOLE----------------------------+
W3 /usr/local/kds/TEMP3                              Row 4 of 24 Col 1 of 95  A
```



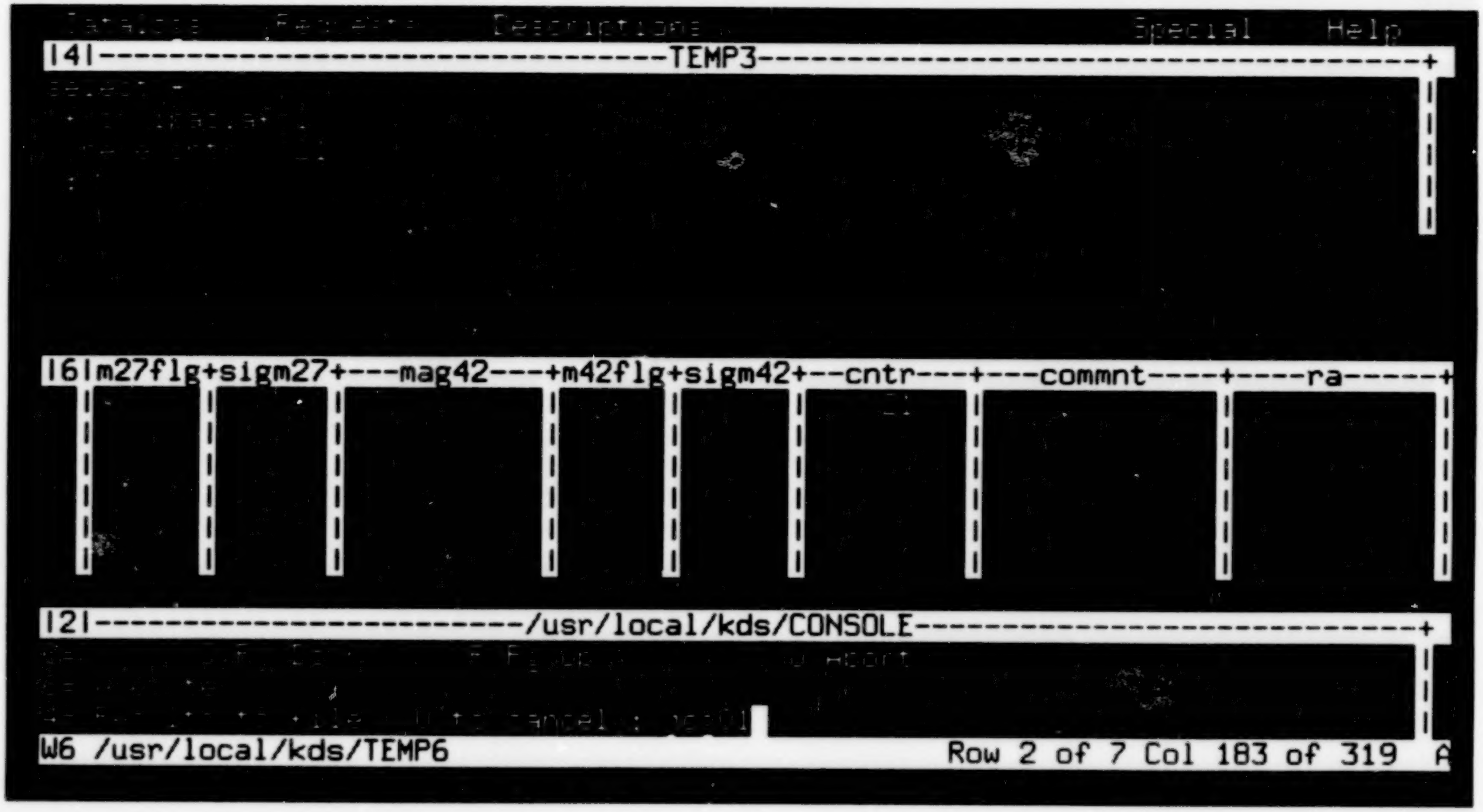
```
                        Descriptions
|5|-----------The Revi                        Survey Catalog-------------------

                       Field list

|2|----------------------/usr/local/kds/CONSOLE------------------------------+

W5 /usr/local/kds/TEMP5                          Row 5 of 22 Col 14 of 95
```



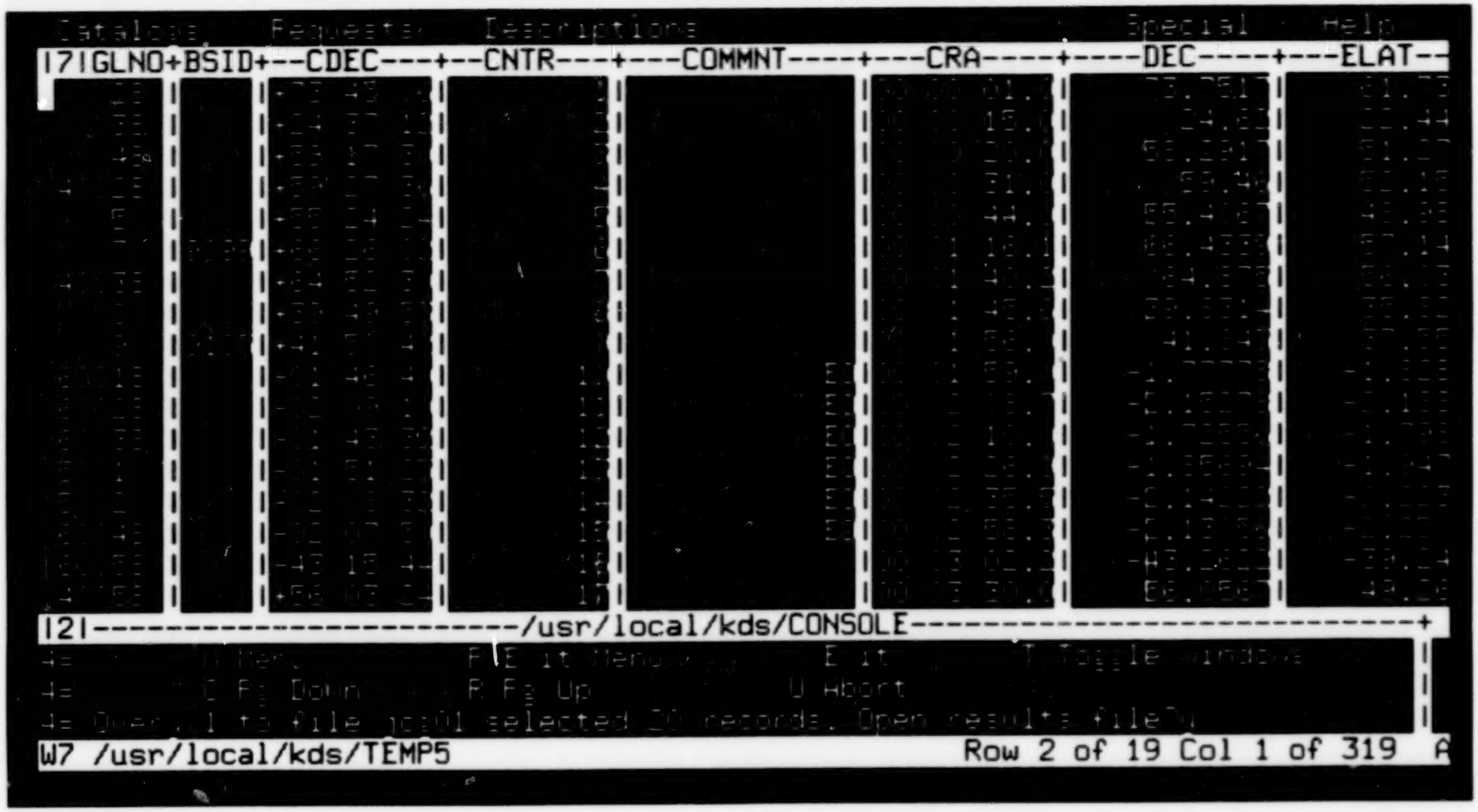
```
|4|Name--+----Units-----+-----------Description-----------------------------+
 MAG11  |  Mag          |  Magnitude of 11 microns.  '-9.9' - unavailable   |
|5|-----------The Revised AFGL Infrared Sky Survey Catalog-------------------
|2|-----------------------/usr/local/kds/CONSOLE----------------------------+
W4 /usr/local/kds/TEMP3                              Row 13 of 30 Col 1 of 95  A
```



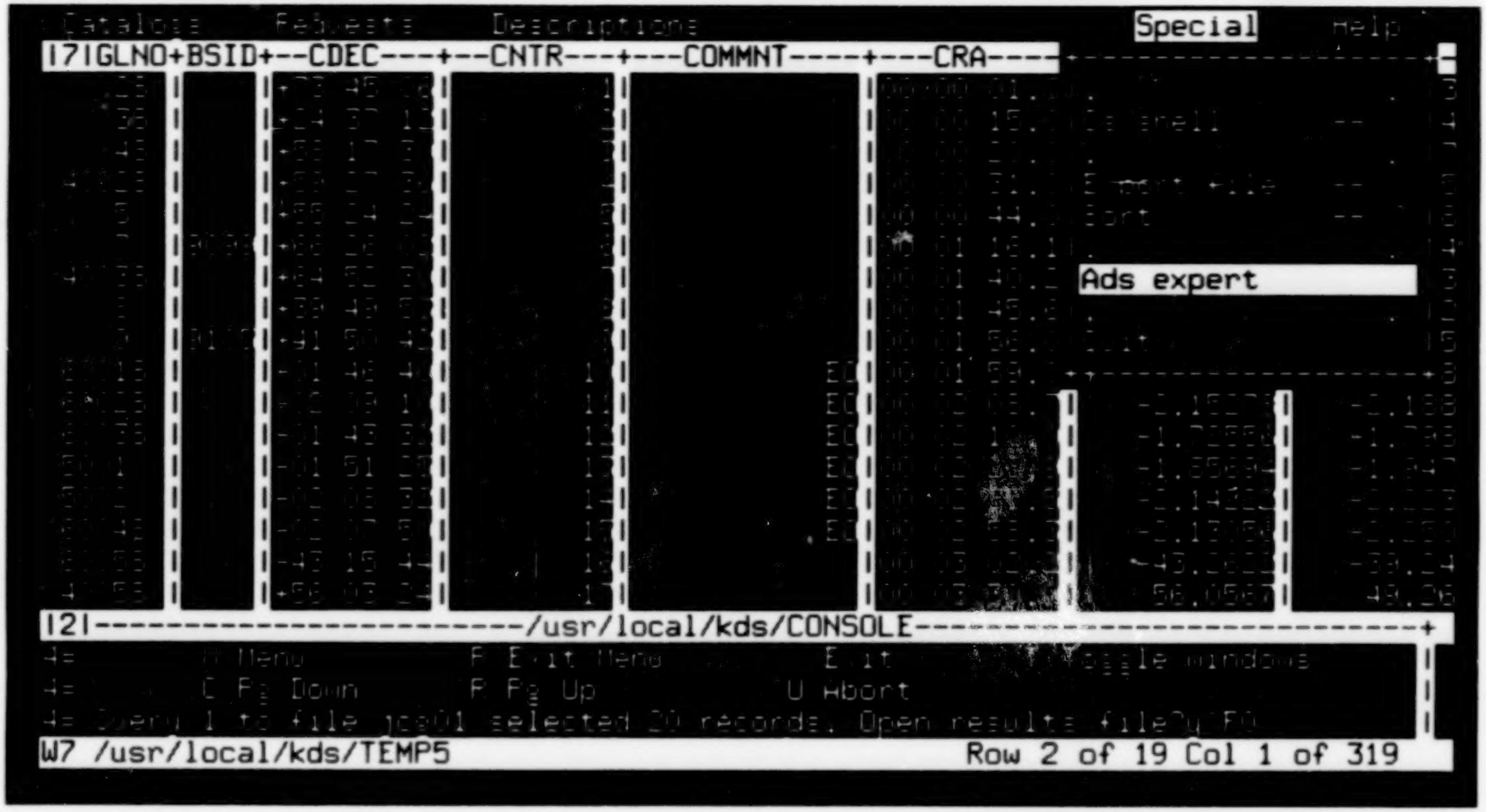
```
 Catalogs    Requests    Descriptions                              Special ..-Help
|6|m27flg+sigm27+---mag42---+m42flg+sigm42+--cntr---+---commnt----+----ra-----+
|7|-------------------------ADS_INSTRUCTIONS-------------------------------------+
      p) to print.    value) for ... Enter  E to execute
A complete dissertation on the usage of DBE is beyond the scope of this
help (see the ADS User's Guide). Basically, control sequences are placed
in each column to determine the SQL used for a DBMS search.  The basic
sequences are:
|2|-----------------------/usr/local/kds/CONSOLE---------------------------------+
Esc    ... Menu          F Exit Menu           E Exit        T Toggle windows
Esc      C Pg Down         R Pg Up            U Abort
W6 /usr/local/kds/TEMP6                         Row 2 of 7 Col 183 of 319  A
```


Descriptions
Special
Help

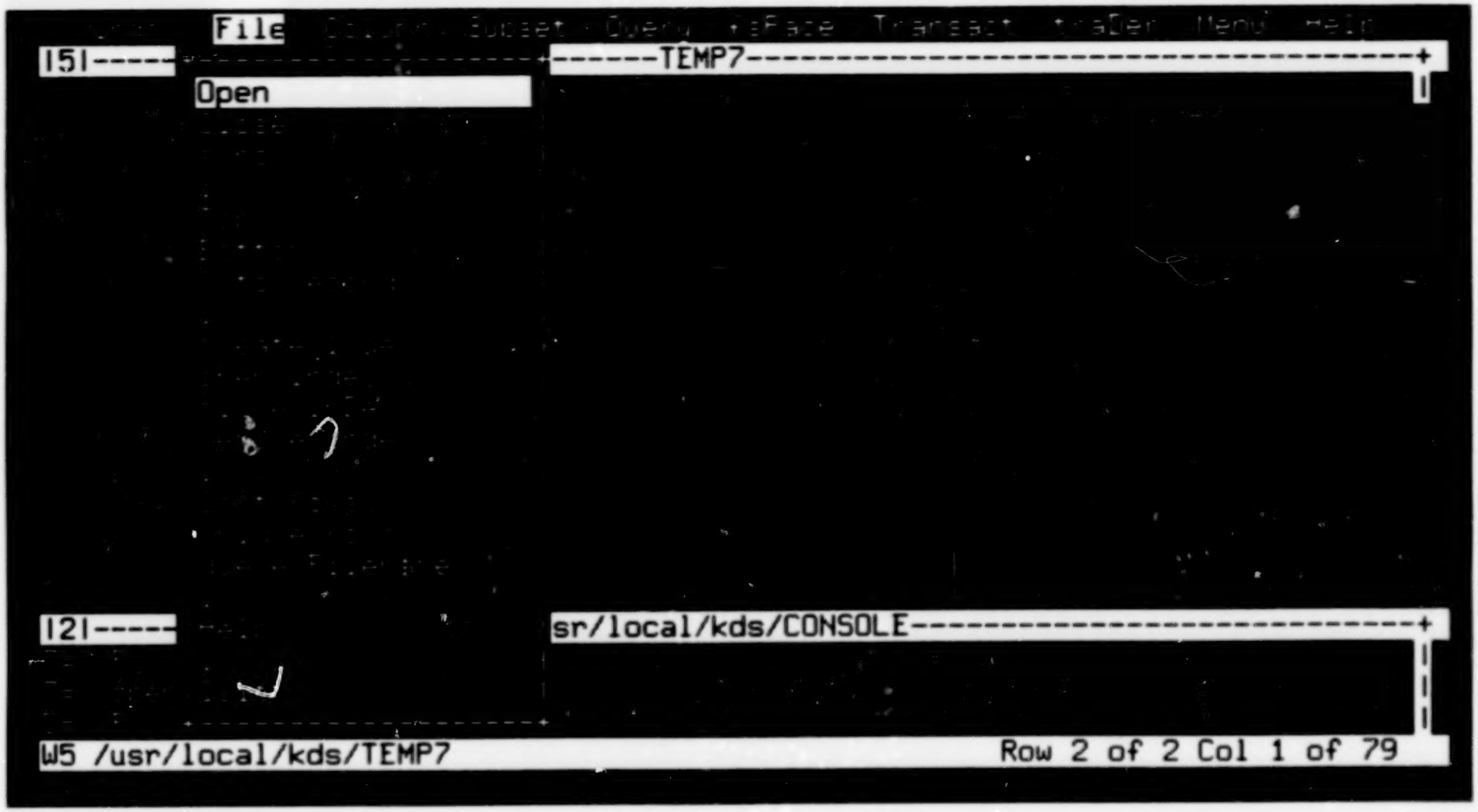
```
|4|--------------------------------TEMP3-----------------------------------------+

|6|m27flg+sigm27+---mag42---+m42flg+sigm42+--cntr---+---commnt----+----ra-----+

|2|---------------------/usr/local/kds/CONSOLE-----------------------------------+

W6 /usr/local/kds/TEMP6                              Row 2 of 7 Col 183 of 319  A
```


Catalogs
Requests
Descriptions
Special
Help

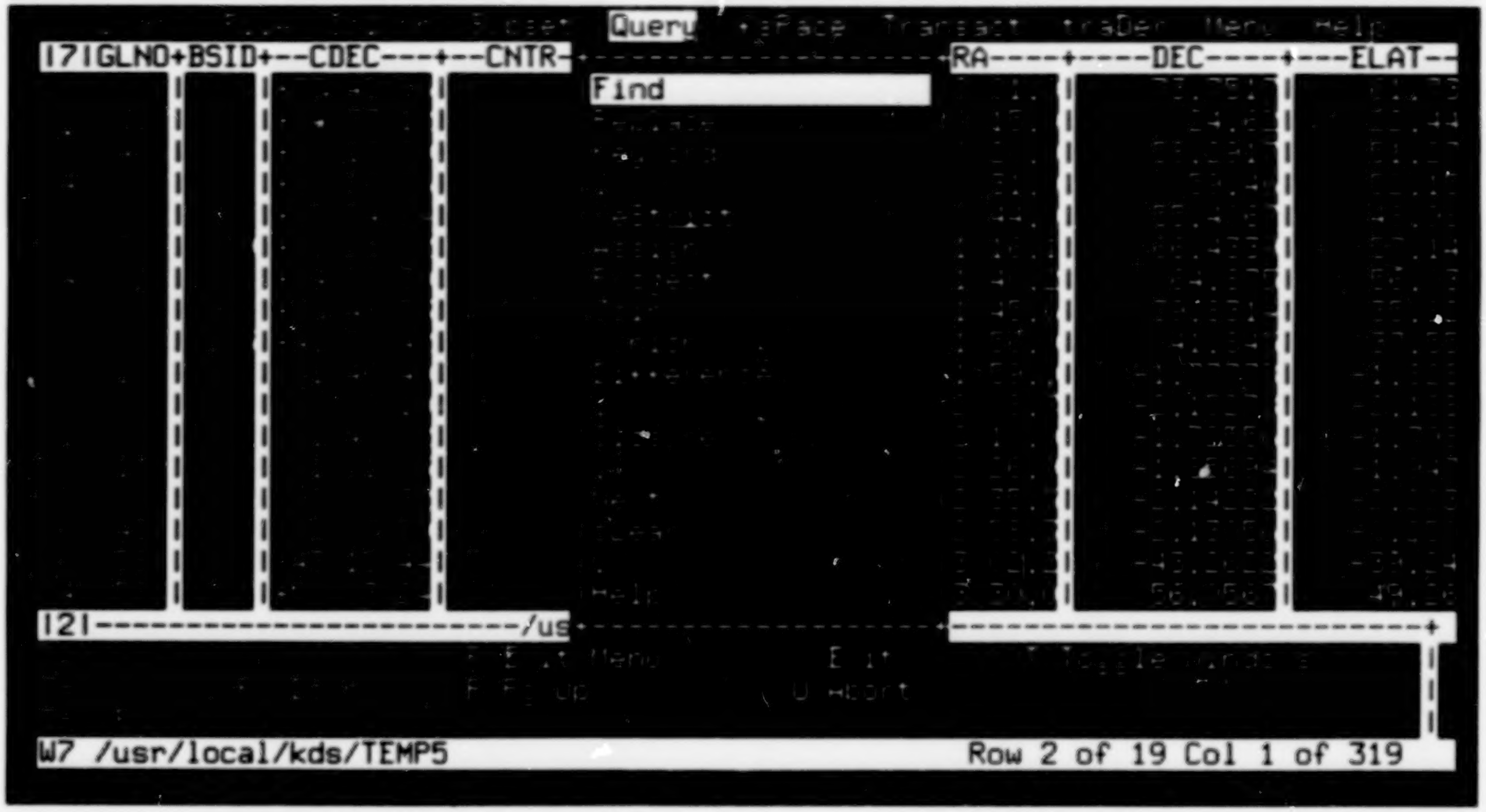
```
|7|GLNO+BSID+--CDEC---+--CNTR---+---COMMNT----+---CRA----+----DEC----+---ELAT--
|2|-----------------------/usr/local/kds/CONSOLE------------------------------+
W7 /usr/local/kds/TEMP5                                Row 2 of 19 Col 1 of 319  A
```


Catalogs
Requests
Descriptions
Special
Help
Export File
Sort
Ads expert
Quit

```
|7|GLNO+BSID+--CDEC---+--CNTR---+---COMMNT----+---CRA----
|2|-----------------------/usr/local/kds/CONSOLE------------------------+
4=        A Menu          F Exit Menu          E Exit          Toggle windows
4=        C Pg Down       R Pg Up            U Abort
4= Query 1 to file jcs01 selected 20 records. Open results file?y/RO
W7 /usr/local/kds/TEMP5                           Row 2 of 19 Col 1 of 319
```


File
Column
Subset
Query
reFace
Transact
traDer
Menu
Help
Open

```
|5|-----                              ------TEMP7------------------------------------+
|2|-----                              sr/local/kds/CONSOLE----------------------------+
W5 /usr/local/kds/TEMP7                                     Row 2 of 2 Col 1 of 79
```


Subset
Query
Transact
Menu
Help
Find
Help
Exit
Abort

```
|7|GLNO+BSID+--CDEC---+--CNTR-                    RA----+----DEC----+---ELAT--
|2|-----------------------/us                     ------------------------------+
W7 /usr/local/kds/TEMP5                           Row 2 of 19 Col 1 of 319
```

OVERVIEW OF THE ASTROPHYSICS DATA SYSTEM

John C. Good and Richard B. Pomphrey
Infrared Processing and Analysis Center
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA 91125

Abstract

The Astrophysics Division of NASA has built a geographically- and logically-distributed heterogeneous information system for the dissemination and coordinated multispectral analysis of data from astrophysics missions. The Astrophysics Data System (ADS) is a truly distributed system in which the data and the required processing are physically distributed. To accommodate the anticipated growth and changes in both requirements and technology, the ADS employs a server/client architecture which allows services and data to be added or replaced without having to change the basic architecture or interfaces. Current datasets accessible through the system include all the tabular astronomical data available at each of six existing astrophysics data centers. Additional data nodes, at both NASA data centers and academic institutions, will be added shortly. The future evolution of the system will be driven in large part by user services mounted both by the ADS project itself and by members of the astrophysics community.

Astrophysics Data System Philosophy and Strategy

Astrophysicists today have a bewildering array of powerful NASA resources to call upon. Among these are the data centers for the High Energy Astrophysics Observatories (HEAO's), the International Ultraviolet Explorer (IUE), the Infrared Processing and Analysis Center (IPAC), and the Hubble Space Telescope Science Institute (STScI), as well as the National Space Science Data Center (NSSDC). Unfortunately, the services provided by these centers are essentially independent and some are only accessible through mission-unique hardware and software. Furthermore, they can generally only be accessed directly through the centers themselves.

The Final Report of the Astrophysics Data System Study, March 1988, characterized the data environment of the Astrophysics community at that time and defined for the future an "... architecture for a date system which will serve the astrophysics community in multi-spectral research through the decade of the 1990's." One of its recommendations was that each data set, and the human expertise which supports the data, be maintained at the same physical location. Moreover, these multiple locations should be linked together and to researchers by means of high speed communications networks. Finally, to allow true multi-spectral research the various data sets should be accessible through a common set of tools.

The Astrophysics Data System (ADS) Project is NASA's response to the Data System Study. For the science investigator, the ADS makes NASA's current and future data holdings more broadly and efficiently accessible, and makes the data itself more interpretable. For NASA, it provides a common information system infrastructure for science analysis, thereby reducing duplication of effort while increasing the scientific return from missions.

The ADS is a truly distributed system in which both the data and the required processing are physically distributed. To accommodate anticipated growth and changes in both requirements and technology, the ADS employs a server/client architecture which allows services and data to be added or replaced without having to change the basic architecture or interfaces. The ADS design is modular and layered, enabling smooth evolution of the hardware and software without interruption of service to the user community. In addition, the ADS will provide all on-line information necessary to use the ADS services and data; and its design enables remote updating of the software services.

ADS Software Architecture

Conceptually, the software can be divided into two categories. Core Services are those which provide the basic system functionality upon which user applications or User Services can be built. These will be built primarily by the ADS Project itself. User Services are other applications which reside on the ADS and provide science support and analysis functions required by the investigator. These may be built by the Project in response to community demand or by individuals or groups funded by the NASA Astrophysics Science Research Aids (ASRA) Program.

In its initial release, the ADS will provide basic Core and User Services. These will be expanded and supplemented in the future based on feedback from the Astrophysics community.

Initial Core Services

The MESSAGE PASSING SERVICE (MPS) enables remote inter-operability and data transfer/translation among the ADS services. It provides homogeneity across networks and operating systems for process requests and responses. While this service is largely invisible to the end user, it provides the application programmer (and the ADS system programmers) what the User Interface provides for the science end user: an environment in which to access the services of the ADS from within an application program without knowing which servers will execute the program or the services it accesses. At a minimum, the MPS implements the functionality of:

- Remote Procedure Call (RPC): a mechanism by which the subroutines of a program can call each other as if they were executing on a single server when, in fact, they may be segmented across several servers;

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- Remote Process Invocation (RPI): a mechanism by which a program on one server can spawn programs on other servers;
- Remote Inter-Process Communication (RIPC): a mechanism whereby two or more programs running concurrently on different servers can communicate among themselves.

In the initial release, the ADS Message Passing Service conforms to the Advanced Network System Architecture Testbench (ANSAT) and the Open Software Foundation/Distributed Computing Environment (OSF/DCE).

USER INTERFACES are the services which provide the local working environment (including its look and feel) to the end user. As such they provide a means to access all other services within the ADS. The structure of the ADS is such that there can be any number of user interface programs incorporating the constraints, hardware limitations, and preference of specialized segments of the community. Our efforts to date have concentrated on a single user interface which is structured to conform to a "least common denominator" hardware environment, and which provides an effective interface to the initial set of ADS Services. The ground rules have been:

- the ADS system must be accessible using any character terminal supportable under the UNIX "termcap" facility (basically any display with 24x80 characters and an addressable cursor);
- the ADS system must be effective (if slow) at 1200 baud.
- it must be possible (but not required) to configure the system such that the user interface and appropriate interactive processing is done at the user's site, rather than at centralized facilities.
- the user interface in particular should be available under UNIX, VMS and MS/DOS.

Even with these constraints, we are able to provide an ADS User Interface that provides the following combined functionality:

- specialized table display and interactive manipulation facilities;
- a first-order complete relational database facility including support for Structured Query Language (SQL) and Query by Example (QBE);
- Menu bar/pulldown menus and multiple windows (split-screen);
- context-sensitive help and a dynamic tutorial facility;
- full-featured text management facility that supports browsing, plain-text inquiry and cut-paste editing of selected files.

Through this interface, investigators can locate data sets (descriptions and catalogs) of interest, access these data sets either individually or in combination, and select from among them one or more subsets that they wish to import into a local working environment for further analysis of their own choosing. More importantly, it allows the investigator to accomplish this without requiring him to know which servers execute the services he invokes. In the initial release, the Knowledge Dictionary System (KDS) (tm) is being used to implement the functionality of the User Interface.

The DATA INDEPENDENT ACCESS MODEL (DIAM) is a service which provides inter-operability and language conversion among the various distributed Database Management Systems (DBMS's) in the ADS. These DBMS's include the following: Ingres and Sybase (UNIX), RDB (VMS), and IM/DM (CDC NOS/VE). The DIAM is required in the ADS in order to provide the user with a uniform relational view of all these distributed catalogs even though some of the catalogs are still maintained using DBMS's that do not yet support the relational SQL standard. The functionality of the DIAM is:

- to accept SQL statements generated by the User Interface (either directly or indirectly using the QBE translator);
- to convert them to the language supported by the DBMS that hosts the referenced catalog(s);
- to RPI a process to submit them to the DBMS for processing and to collocate the resulting table(s);
- to return those results to the User Interface that issued the request.

The Distributed Access View Integrated Database (DAVID) system is being used to implement the functionality of the DIAM.

Besides providing uniform access to the multiplicity of existing DBMS's, DAVID provides a complete internal distributed DBMS which allows further processing with special features not available in most commercial DBMS's. Of particular importance in a distributed environment is its ability to allow dataset browsing. This minimizes the overhead potentially incurred by having to transfer data in large chunks around the country.

Future Core Services

There are several Core Services which are important and anticipated in the near future, but which were not included in the initial release of the Astrophysics Data System. Among these are the User/Service Authentication Service and the Transaction Management Service. Other Core Services will be added on as they are required and become available.

The USER/SERVICE AUTHENTICATION SERVICE will provide the capability to automatically verify the authorization of a user to access the ADS System and to access specific services and data within the system. It will be provided through an implementation of the KERBEROS software on the ADS System.

The TRANSACTION MANAGEMENT SERVICE (TMS) will provide the process and resource management protocol for client-defined transactions. It assures successful execution, synchronization, and release of all services and resources used in a transaction. The TMS provides two basic functions:

- insure, without further client intervention, that all the services requested during a transaction will be successfully executed even if some of those services or the servers on which they are executing fail while the transaction is in progress;
- insure, without further client intervention, that all resources involved in a transaction are properly synchronized and released regardless of the destiny of the transaction (success or failure).

The TMS is both an optional and a passive service: optional in that it must be explicitly invoked by the client: and passive in that, as a peer-to-peer system, there is no mechanism by which the TMS protocol can be enforced, and the only programs that are guaranteed to participate in the TM protocol are the core services of the ADS. To encourage the use of the TM by end-users and application programmers, the protocol has been kept as simple as possible, requiring only four commands: Begin, Lock, Upgrade, and End.

Begin is a signal that a program is starting and returns a unique Transaction ID that the program must use in all subsequent calls to the TM. Lock signals the intent of the program to access the resource (e.g., a record in a file) named in the call. Upgrade signals the intent of the program to modify a previously Locked resource. End signals that the program is terminating, and the mode of termination (success or failure). For the initial ADS release, the components of the Transaction Management Service are implemented by the Transaction Manager (tm), which is an integral part of the Knowledge Dictionary System (tm). The TMS components will be exported as discrete services through the Message Passing Service through which they will be accessible by Remote Procedure Calls.

Initial User Services

The initial User Services available through the ADS have usually been collectively referred to as Directory Services, with components that provide access to catalog data and to documentation about data holdings for specific Astrophysics archives, without requiring the user to know where the data physically resides. These Directory Services include Document Retrieval, Documentation Browse, and a Catalog Data Retrieval and Processing Service. Astrophysics data comes in several forms (e.g., catalog data, spectral data, image data). The initial release of the ADS will be limited to catalog data (though some of the catalogs are in fact lists of images or spectral observations).

The DOCUMENT RETRIEVAL SERVICE provides uniform, subject-matter indexing (and English-language querying) across all the data in the ADS, regardless of whether data are highly structured in databases, or unstructured. For the initial release, the Document Retrieval Service is implemented by the Factor Space Access Method (tm) as an integral part of the Knowledge Dictionary System (tm). The various components of the Document Retrieval Service will be exported as discrete services through the Message Passing Service, through which they can be generally accessed by Remote Procedure Calls.

The Factor Space (FS) is an n-dimensional Euclidian space, the axes of which are statistically constructed to account for the variance and covariance in expert judgments made by astrophysicists about the relevance of ADS data items to different subject matter contexts. The functions of the Document Retrieval service are:

- to scan all data entered in the ADS and compute its subject matter profile as a sequence of one or more vectors in the Factor Space;
- to similarly analyze natural language requests and to search the Factor Space for relevant data items;
- to monitor the distribution of vectors in Factor Space for clusters (i.e., undifferentiated data items);
- to periodically generate, disseminate, collect and synthesize questionnaires to obtain additional relevance judgments needed to increase the data resolution;
- to factor-analyze these additional relevance judgments and modify the number and/or orientation of axes in the Factor Space accordingly.

These functions also support the generation of new Factor Spaces, either to accommodate new subject matter or to accommodate personalized perspectives on existing subject matter.

The DATA BROWSE SERVICE provides a simple means for users to access and organize directories and files through the functionality of the User Interface described above.

The DATA RETRIEVAL AND PROCESSING SERVICE provides the capability to retrieve cataloged data and perform data base management processing on that data through the query, text management, and relational data base functionality of the DIAM and User Interface services described above.

Future User Services

It is expected that other User Services will be made available as they are requested by the Astrophysics user community and integrated into the ADS. Because of the flexible modular nature of the ADS architecture, such integrations should be relatively straightforward and can be implemented in a variety of ways, dependent on how the prospective User Service is coded. These new services can be derived from any of the following sources:

- Astrophysics Science Research Aids (ASRA) Program
- NASA Astrophysics Flight Projects
- Other NASA Flight Projects
- Other NASA Programs
- Non-NASA Programs
- Non-US Programs

ADS Physical Architecture

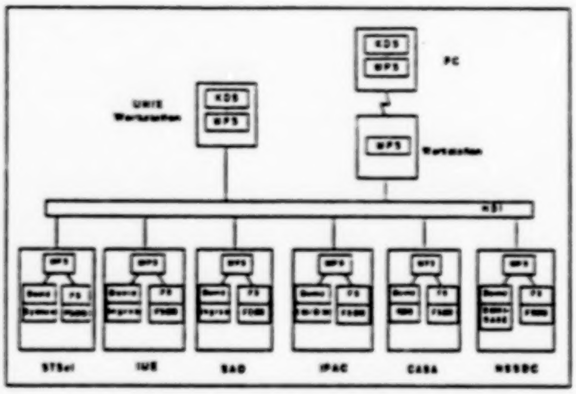
An overview of the ADS physical architecture is presented in the figure below. In its initial instantiation, the ADS will consist of six physically distributed primary nodes which are interconnected via NASA Science Internet (NSI). These six nodes are the following:

- Center for Astronomy and Space Astrophysics CASA), Boulder, Colorado
- Infrared Processing and Analysis Center (IPAC), Pasadena, California
- International Ultraviolet Explorer (IUE), Greenbelt, Maryland
- National Space Science Data Center (NSSDC), Greenbelt, Maryland

- Smithsonian Astrophysical Observatory (SAO), Boston, Massachusetts
- Space Telescope Science Institute (STScI), Baltimore, Maryland

Platforms and Operating Systems

Each of these nodes above has important astrophysics catalogs for which it has principal responsibility. In general, these catalogs are maintained in different types of DBMS's on different types of machines, each of which runs a unique operating system. Components of the ADS Core Services will be resident on a server at each node and connected by the ADS Message Passing Service software. (See the ADS Primary Nodes Compatibility Requirements Document for a more detailed description of the hardware interface.) The mapping of services to servers in the ADS is unconstrained: some servers simultaneously provide several (simple) services while some (complex) services are segmented across several servers. In addition, the numbers and kinds of services that can be mounted on the ADS are also unconstrained.



Physical/Logical Organization of Representative ADS Services.

Nodes and Sites

The ADS will be composed of Primary and Secondary Nodes, an Administrative Node, and User Sites.

An ADS primary node is defined as a facility which assumes primary responsibility for the provision of a unique service through the ADS infrastructure. This service can involve the provision of basic mission-specific data, as would be the case for a mission science support center like IUE, or for the provision of an operational service for remote access such as the IPAC-supported NASA Extragalactic Database (NED).

A Primary Node assumes the responsibility for user support, maintenance of user services, data, and appropriate documentation it provides via the ADS. Many different kinds of services may be offered by primary nodes in the future, such as access to data archives or use of specialized processors or software.

A Secondary Node is not responsible for user support or for maintenance of data or service provided by the node. Its role is to provide local or regional copies of data or services. Provision for such copies should alleviate the load on the primary nodes and greatly improve the responsiveness and reliability of the system.

The ADS will also maintain an administrative node whose primary functions are to monitor the system (the user/service database, network throughput and connectivity, usage patterns, service availability, and security), and to serve as the top of the hierarchy that deals with user questions, problems and training.

A site is defined as any physical location, outside of an ADS Node, where ADS-specific software exists (e.g., the User Interface, MPS, or DIAM) through which an investigator accesses the ADS or its services.

Networking

The first release of the ADS required network connectivity among the primary nodes and remote users (those not physically located at one of the primary nodes). This network connectivity will be furnished by the NASA Science Internet (NSI) which supports the TCP/IP protocol. While it is intended that the ADS will eventually support the DECNET protocol, this will not be the case for the first ADS release.

User Scenario

The prospective user of the Astrophysics Data System should first obtain a copy of the ADS User's Guide (contact the administrative node at the address at the end of this document), which will give specific details of how to obtain access to the ADS System. Generally a user will be assigned to one of the ADS Primary Nodes for user support.

It is assumed that the user is a novice and is trying to do a very simple, well-defined task but one which requires access to multiple astrophysics data centers and their on-line databases. In this scenario, the user will locate and subset two independent datasets and then intercompare the results. Specifically, the problem is to correlate measurements of galaxies which have been observed to have both a significant infrared flux (indicative of a large amount of cold dust), and an X-ray or ultraviolet flux (indicative of hot gas).

The user first asks about the existence of 100 μm (infrared) data, and ultimately finds his/her way to the IRAS Point Source Catalog. This user then wants to know if a subset of IRAS sources (e.g. galaxies that lie above 30 degrees galactic latitude with 100 μm flux greater than 10 Janskys and 60/100 μm flux ratios indicative of temperatures less than 40K) have been observed in the X-ray (Einstein Catalog).

Further, for those sources which were observed both in the infrared and with Einstein list the ones detected in IR and X-ray and plot the IR flux versus the X-ray flux for these objects.

The specific steps are outlined below:

Locating Infrared Datasets

If we consider all the datasets potentially available in astrophysics (not just the 'standard' products of NASA missions), the potential size and diversity of these datasets become quite large. Without data location tools, locating the correct dataset for our investigation would be at least as difficult, if not more so, than the processing we will do once the data is found. In most cases accessing this data would be much more difficult than processing it.

One of the primary services of the initial ADS implementation is the factor space documentation location method described above. With this we can pose a factor space query of the type "I am interested in long wavelength infrared measurements of galaxies, particularly 100 μm measurements, in the form of catalogs. Color temperatures, specifically ones derived from long wavelength measurements, will be correlated with X-ray data to try and determine the relationship between cold dust emission and that from hot gas".

The factor space query will return a list of documents, some of which might be journal articles about similar research, some descriptions of catalogs or other data (e.g., images), some mission descriptions, etc. Somewhere near the top of this list is likely to be the description of the IRAS Point Source Catalog. Unless we have been distracted by some of the other documents, we will read this and decide that this catalog is indeed what we want for our IR data. By poking around the documentation related to this catalog (a simple browse mechanism through our documentation) we also determine what fields in the catalog are important for our investigation.

The documents used in the search are maintained at the same institutions that bear responsibility for the data itself.

Locating the X-ray Datasets

The X-ray data (in particular the Einstein database) would be found the same way. One of the rules of the ADS is that catalog datasets are not made accessible through the system until appropriate documentation is also online.

Extracting the IR Data

We have determined the correct catalog and even have some idea as to which fields are appropriate for our endeavor. The next step is to actually query the database where the data resides and get our subset. The basis for such queries is SQL, as described in the section on our DIAM (DAVID). Our query will look something like:

```
select * from iraspsc where flux100>10 and
flux60<flux100 and (glat>30 or glat<-30)
```

In addition to a direct SQL query capability, ADS provides a more intuitive query by example (QBE) mechanism where the user puts constraint information directly into a template of the catalog in question.

The infrared data of interest is located at the Infrared Processing and Analysis Center at the California Institute of Technology in Pasadena, California on a CDC Cyber mainframe in the IM/DM database.

Extracting the relevant X-ray Data

To compare sources which both have an X-ray flux in the Einstein catalog and correspond to the sources obtained from our infrared query, requires the use of SQL for a database join. This is complicated somewhat by the need to potentially transform coordinates from one system or representation and then to perform the join based on spherical distance proximity. This process can also be performed using SQL directly or through the QBE mechanism described above.

Selection of the data must be done at the site where the data resides. However, the join process can be done at either data site or at the user's local site. Optimization can be done to try and minimize the amount of data transfer but in practice the user usually wants to see the results of the two 'selects' before joining them and therefore will transfer the data to the local site anyway.

The X-ray data will be at the Harvard-Smithsonian Astrophysical Observatory in Cambridge, Massachusetts in INGRES on a SUN workstation.

Comparison of IR and X-ray Data

Once the join has been completed, the result is a single table in which are combined IR and X-ray measurements. Proximity on the sky was the deciding factor in matching sources and so we may well want to edit this table in a spreadsheet manner before proceeding. The final step in this example is simply to plot one column in this table versus another.

Table processing and plotting will be performed locally to the user.

System Management Summary

The ADS Program is currently managed from the Science Operations Branch, Astrophysics Division, NASA Headquarters, Washington, D.C. under Guenter Riegler. The ADS Project has been established at the Infrared Processing and Analysis Center which has also been designated as the ADS Administrative Node. Dr. John Good is the ADS Project Manager and is responsible for the activities of the Administrative Node.

Management of the overall ADS effort includes System Development, System Oversight, and System Administration. What follows is a summary of the more detailed material documented in the ADS Management Plan.

System Development

The design of the ADS is motivated by the fact that it exists in a dynamic science and information system environment, and therefore it must be a dynamic system. Thus, even as the ADS is released, development continues on Core Services, User Services, Network Connectivity, and the addition of new nodes. System Management is responsible for technical oversight of prototyping research, selection criteria, development of standards and conventions, and all aspects of systems integration, test, and operation of new or revised ADS services.

System Oversight and Review Process

To date, oversight of ADS development has been provided by the ADS Working Group, under the leadership of James Weiss and John Nousek. When ADS becomes operational (and new nodes and sites are added to the system), the operation and continued development of the ADS will be overseen from both a users' and a systems perspective by an anticipated hierarchy of committees. These committees will review all proposals for ADS development, and will integrate, prioritize, and make policy recommendations on all aspects of the ADS Program.

The Science Operation/Management Operations Working Group (SOMOWG) has the highest oversight and review responsibility. As a matter of policy, the Science Operations Branch will make final selection of new ADS services, based on the results of the proposal and peer review process. For this purpose, an annual NASA Research Announcement (NRA) for the Astrophysics Software and Research Aids (ASRA) Program will be issued.

System Administration

The administration of the Astrophysics Data System is shared by NASA Headquarters, Astrophysics Division (Programmatic), the ADS Project Office/ADS Administrative Node (Project), and the other primary nodes making up the ADS. The organizational structure, and defined roles and responsibilities are documented in Appendix A and the text of the ADS Management Plan, and in the ADS Primary Node Compatibility Requirements.

Development responsibilities include administration of both in-house and external service development contracts, certification of software, and software licensing.

Operations Responsibilities include administration of maintenance contracts, system monitoring, system change control, and maintenance of system documentation.

In addition, the administration and coordination of all aspects of the review processes relevant to the ADS are the responsibility of the System Administration.

Further information on the ADS can be obtained by contacting Dr. Good at

Internet	jcg@ipac.caltech.edu
BITnet	jcg%ipac@HAMLET.BitNet
Telemail	[JGOOD/NASA]NASAMAIL/USA
uucp	(cit-vax,trwrb!csula-ps)!ipac!jcg
SPAN	ROMEO::"jcg%ipac"

TEL: (818) 584-2939
FAX: (818) 584-9945

The work described in this paper was supported by the Jet Propulsion Laboratory, California Institute of Technology, under the sponsorship of the Astrophysics Division of NASA's Office of Space Science and Applications.

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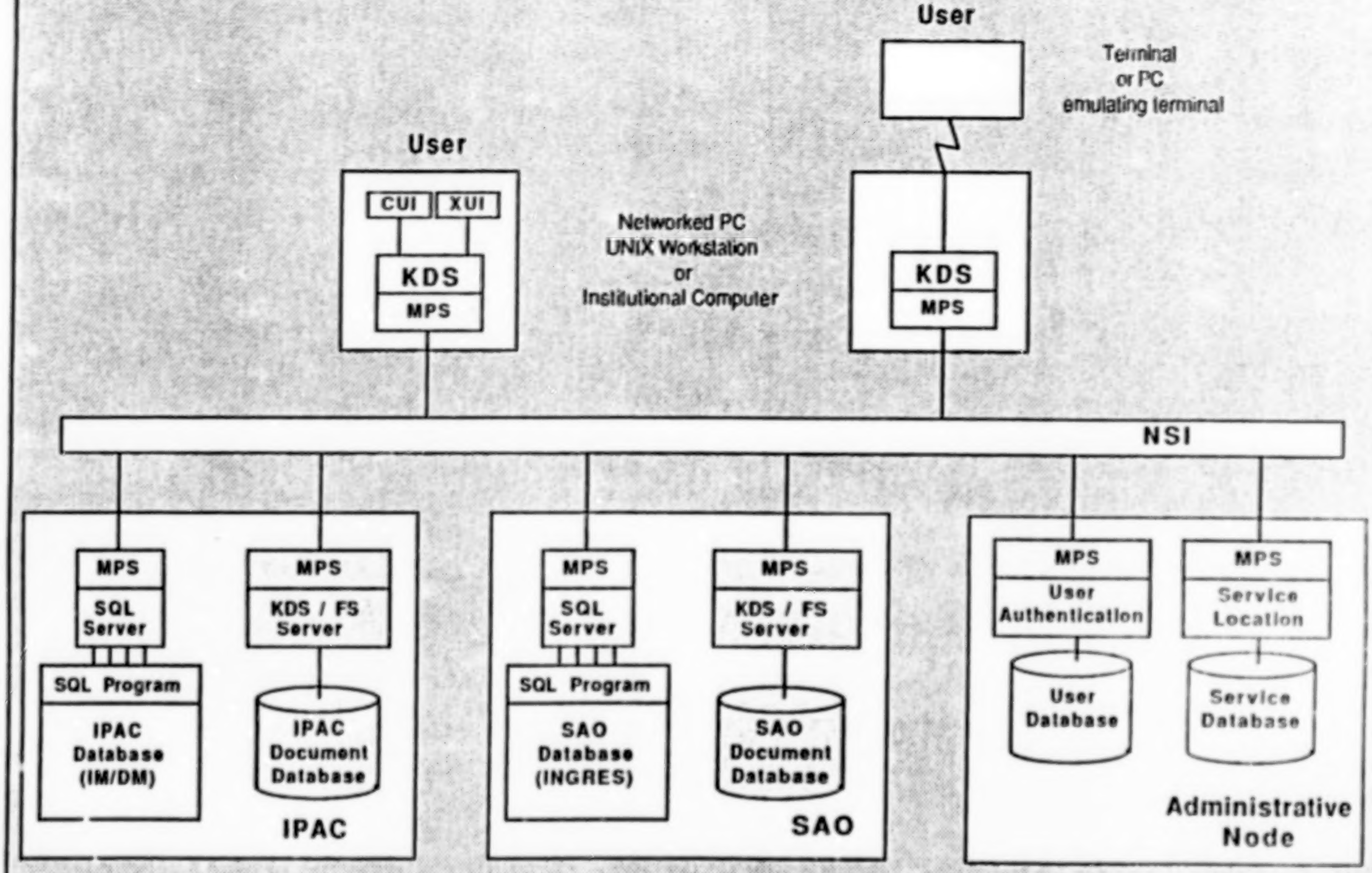
ASTROPHYSICS DATA SYSTEM



User

Terminal
or PC
emulating terminal

KDS
MPS

User

CUI
XUI
KDS
MPS

Networked PC
UNIX Workstation
or
Institutional Computer

NSI

MPS
SQL Server
SQL Program
IPAC Database (IM/DM)

MPS
KDS / FS Server
IPAC Document Database

IPAC

MPS
SQL Server
SQL Program
SAO Database (INGRES)

MPS
KDS / FS Server
SAO Document Database

SAO

MPS
User Authentication
User Database

MPS
Service Location
Service Database

Administrative Node

1/31/91

USING HST:

"From Proposal To Science"

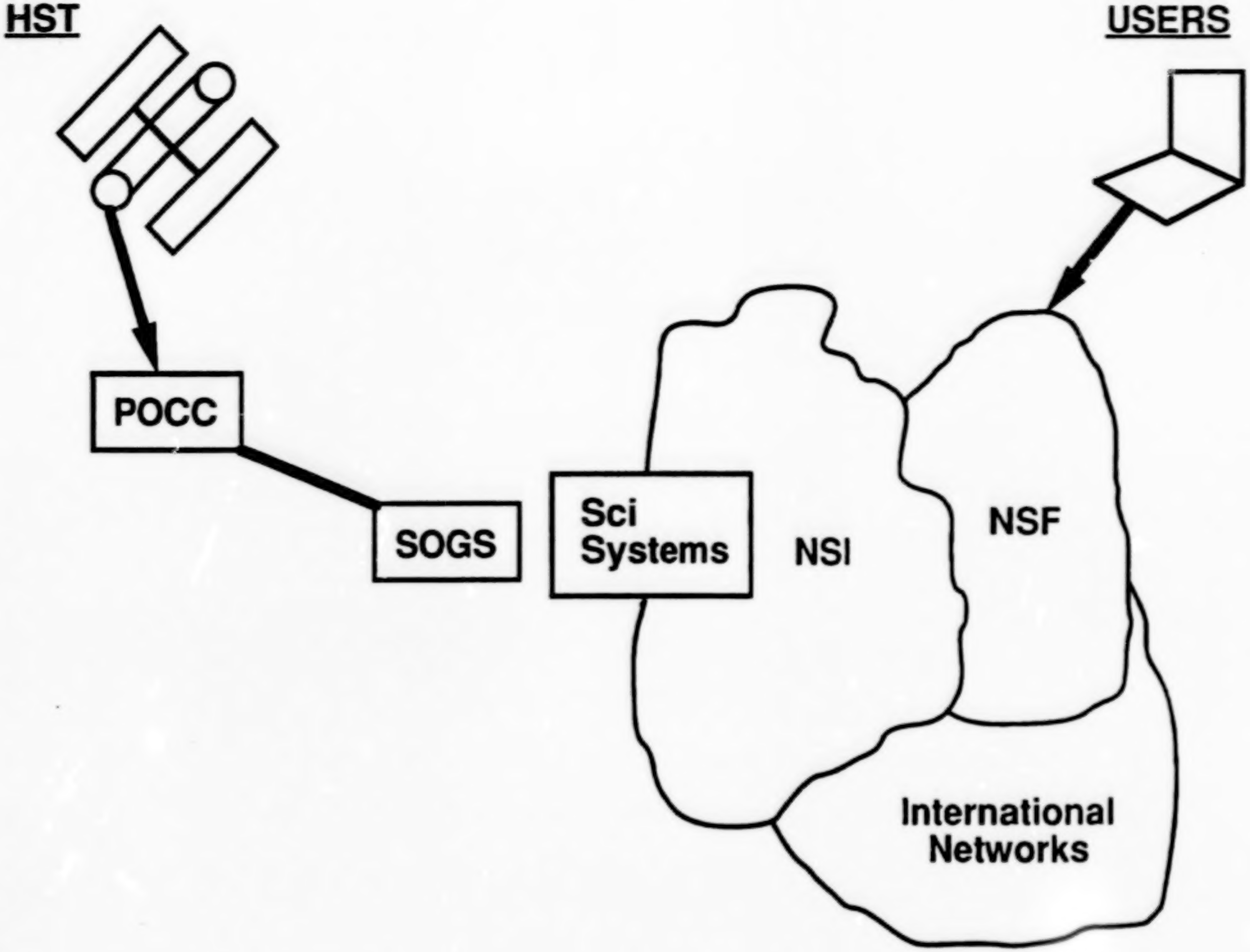
P. SHAMES
13 FEB 91

A SHORT HISTORY:

- Use Of Modems Denied, 1982
- Astronet Project, 1985
- Internet Link @ 56Kb, 1986
  (NOAO & NRAO Supported @ 9.6Kb)
- SPAN Link @ 9.6Kb, 1986
- Dual Protocol Proteon, 1989 @ 56Kb
- T1 Link, 1991

USES OF NETWORKS @ STSCII

- General Communication
  - National & International User Community
  - All Protocols (Bitnet, Internet, Decnet, X.25)
- Science Collaboration
- Functional Activities
  - Distributed Development (TRW & ST-ECF)
  - Proposal Submission
- Internal Data Management
  - Heterogeneous Environment
  - Science & Operational Uses
- External Data Access
  - Remote Catalog Access DMF
  - [ADS Integration]
  - [DADS Futures]



HST

USERS

POCC

SOGS

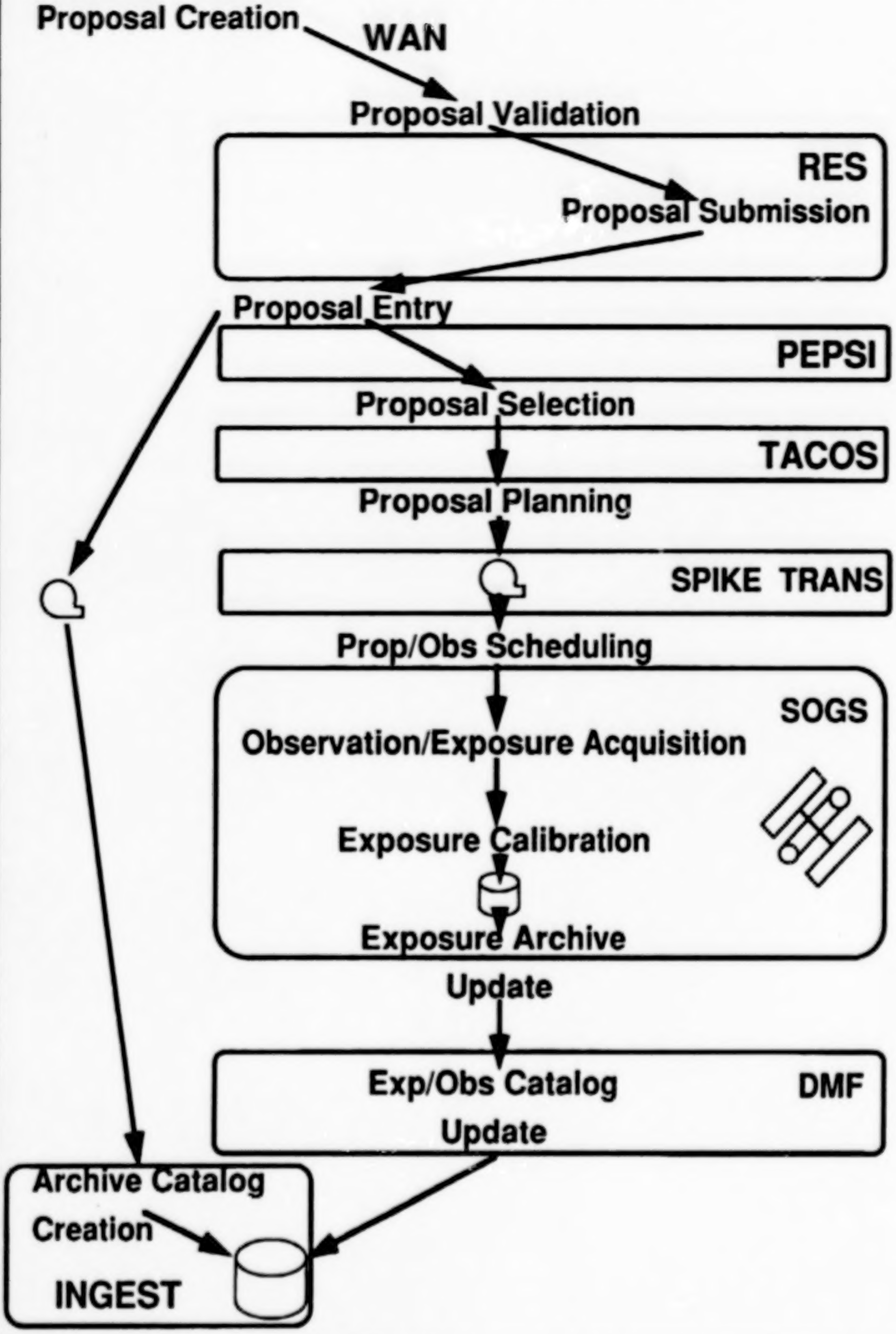
Sci Systems

NSI

NSF

International Networks

Proposal/Observation Handling



Proposal Creation

WAN

Proposal Validation

RES

Proposal Submission

Proposal Entry

PEPSI

Proposal Selection

TACOS

Proposal Planning

SPIKE TRANS

Prop/Obs Scheduling

SOGS

Observation/Exposure Acquisition

Exposure Calibration

Exposure Archive Update

Exp/Obs Catalog Update

DMF

Archive Catalog Creation

INGEST

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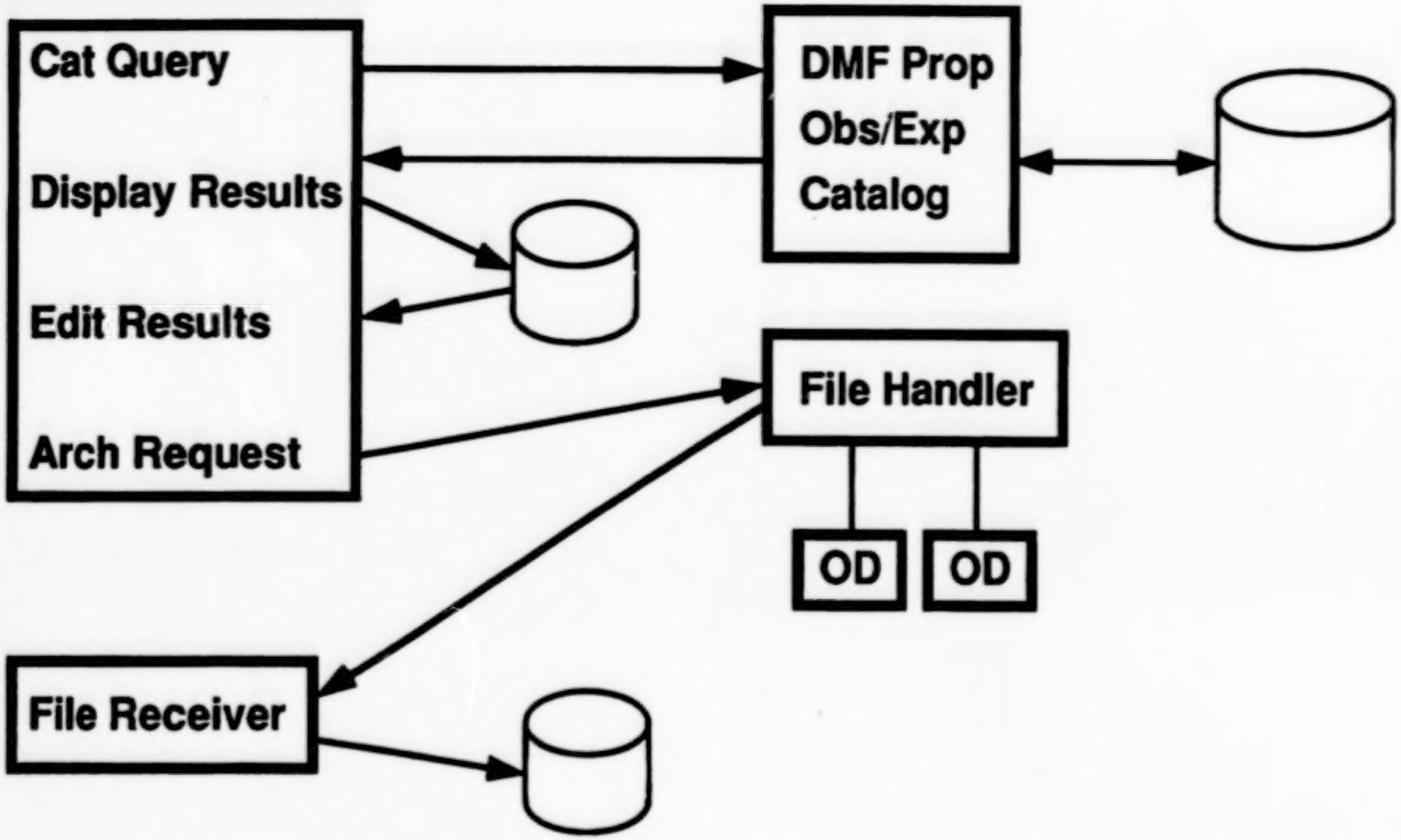
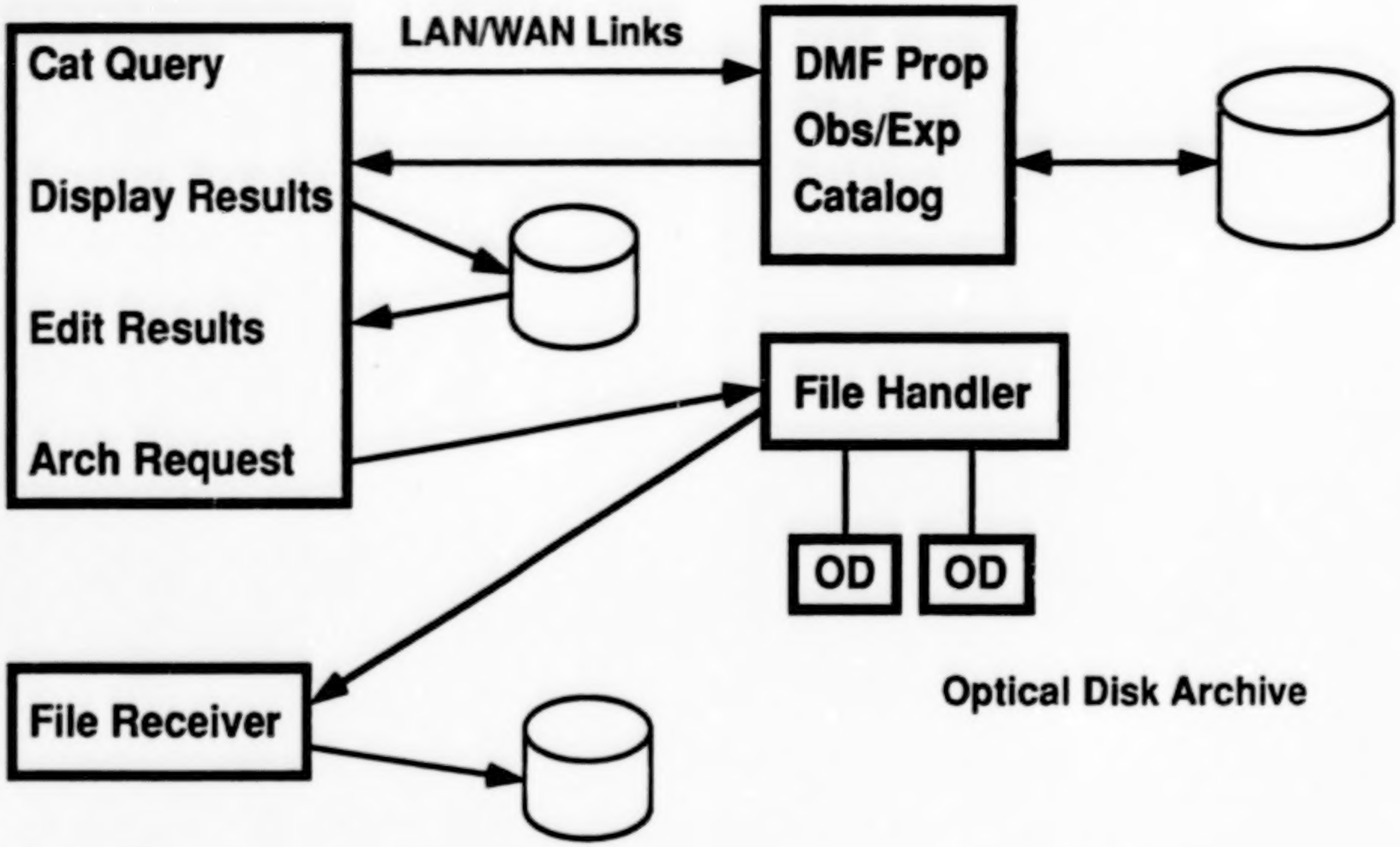
PAGE

DMF ACCESS


Cat Query
Display Results
Edit Results
Arch Request
DMF Prop
Obs/Exp
Catalog
File Handler
OD
OD
File Receiver

FUTURE USES	REQUIREMENTS
Catalog Browse - Direct access - Via ADS	Modest Bandwidth (56Kb)
Archive Browse - Via ADS - DADS	High Bandwidth (T1, TB) Image Compression
Multidisciplinary Analyses - Different wavelengths - Different data types	Common Protocols & Interfaces Data Interchange Standards

DMF ACCESS


LAN/WAN Links
Cat Query
Display Results
Edit Results
Arch Request
DMF Prop
Obs/Exp
Catalog
File Handler
OD
OD
Optical Disk Archive
File Receiver

Expectation: ADS & NREN functionality will be crucial to success of these systems

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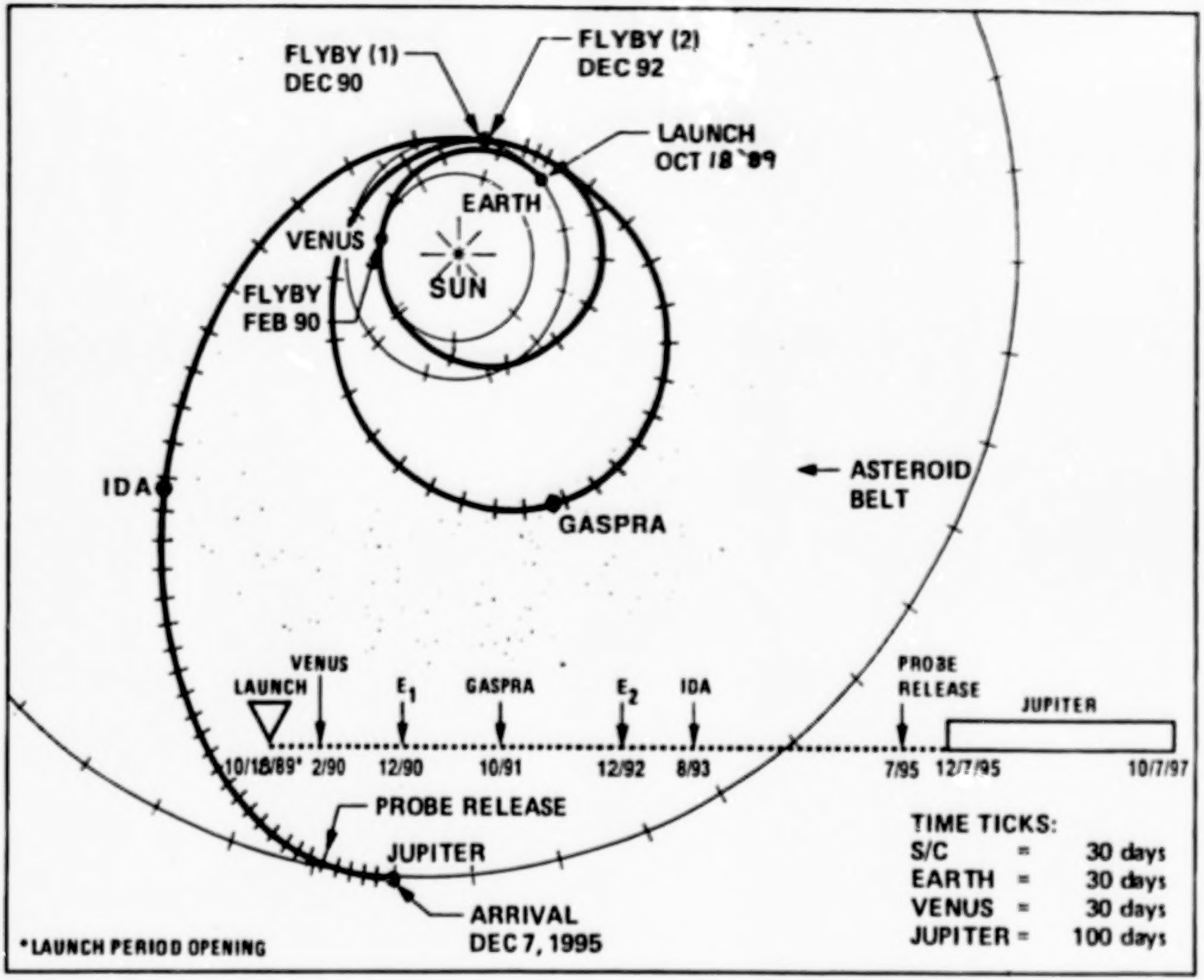
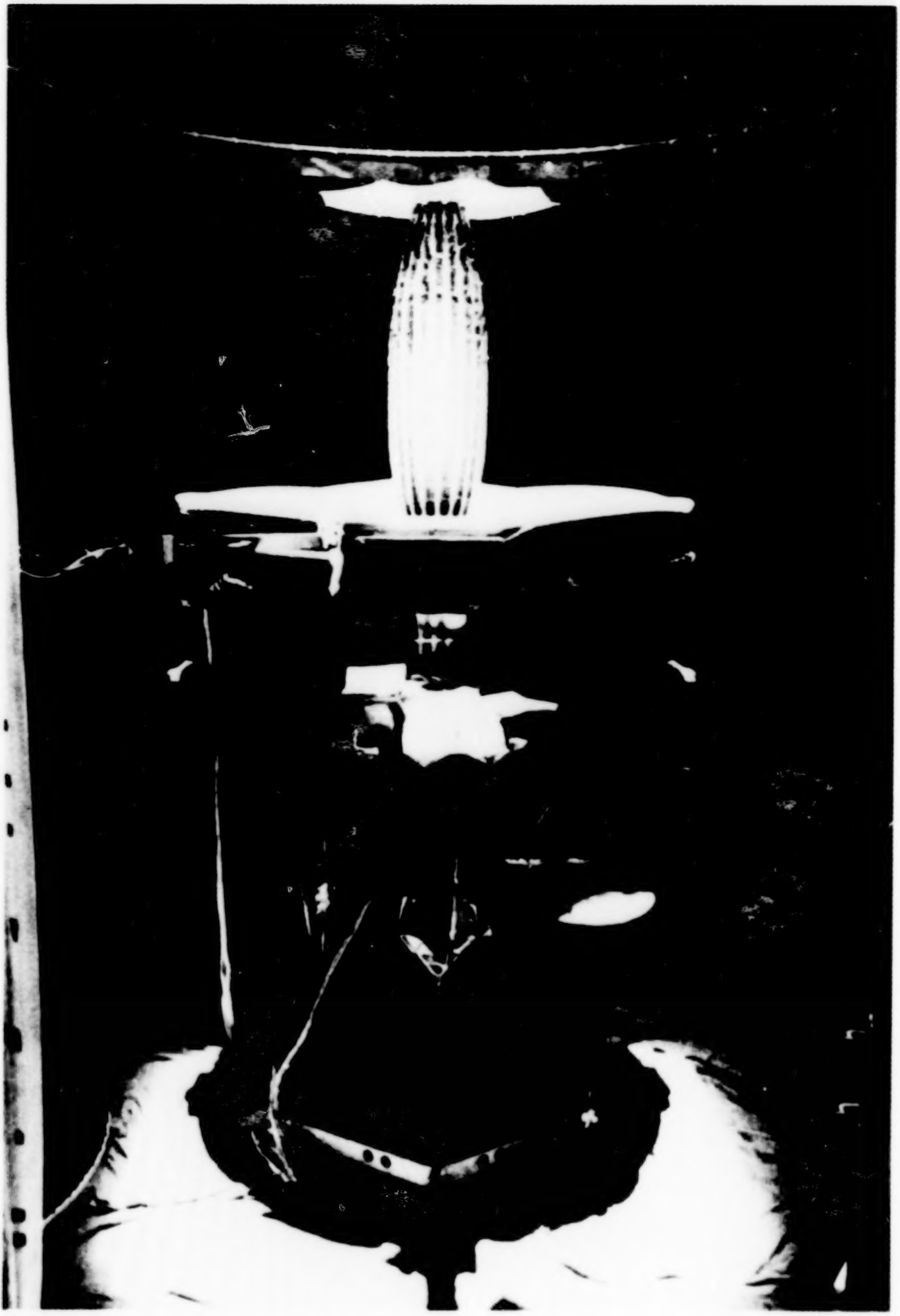
Galileo
THE EARTH ENCOUNTER

PRESENTED TO THE NSIUWG

Theodore C. Clarke
February 13, 1991

GALILEO VEEGA TRAJECTORY TO JUPITER


FLYBY (1)
DEC 90
FLYBY (2)
DEC 92
LAUNCH
OCT 18 '89
EARTH
VENUS
SUN
FLYBY
FEB 90
IDA
GASPRA
ASTEROID
BELT
LAUNCH
VENUS
E1
GASPRA
E2
IDA
PROBE
RELEASE
JUPITER
10/18/89*
2/90
12/90
10/91
12/92
8/93
7/95
12/7/95
10/7/97
PROBE RELEASE
JUPITER
ARRIVAL
DEC 7, 1995
TIME TICKS:
S/C = 30 days
EARTH = 30 days
VENUS = 30 days
JUPITER = 100 days
*LAUNCH PERIOD OPENING



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PAGE

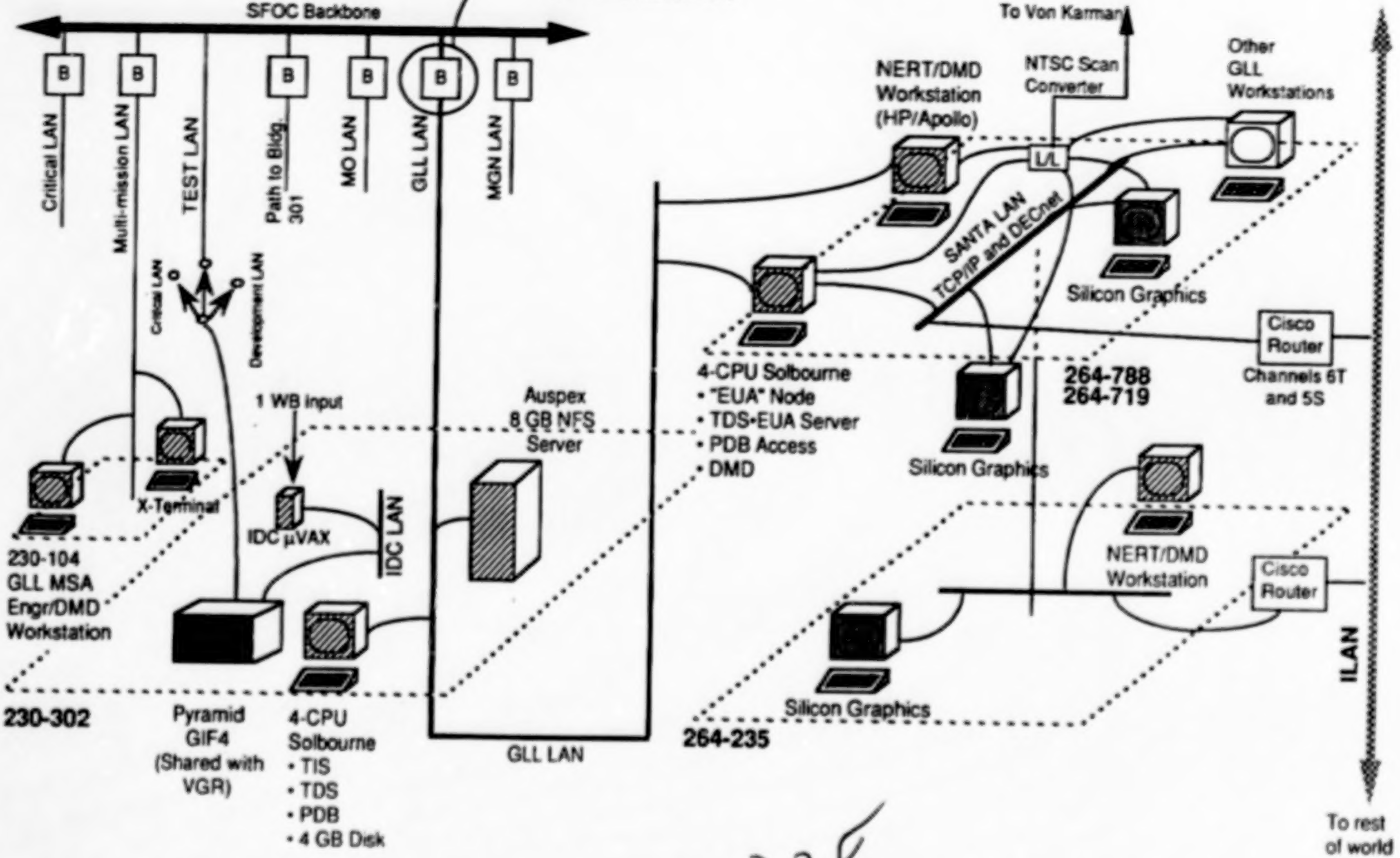
LUNAR SCIENCE OBJECTIVES

- MARE ORIENTALE: COMPOSITION AND MULTISPECTRAL CHARACTERIZATION; SAMPLE DEEP LUNAR INTERIOR; IMPACT PROCESS STUDIES (SSI, NIMS, UVS, PPR)
- LUNAR FARSIDE COVERAGE: ILLUMINATED AND DARKSIDE COMPOSITION AND MULTISPECTRAL CHARACTERIZATION; NEARSIDE/FARSIDE ASYMMETRIES IN THE LUNAR MARIA, HIGHLANDS AND PLAINS (SSI, NIMS, UVS, PPR)
- MAP THE UNMAPPED LUNAR SOUTH POLAR REGION - ~ 105°W LONG, 50°S LATITUDE TO SOUTH POLE (SSI, NIMS, UVS, PPR)
- MAP LUNAR NORTH POLE; SEARCH FOR H_2O IN PERMANENTLY SHADED CRATERS (SSI, NIMS, UVS, PPR)
- SEARCH FOR HYDRATED MATERIAL ON THE MOON (NIMS)
- RADIOMETRIC BRIGHTNESS vs. WAVELENGTH AND POSITION ON LUNAR DISC FOR TOPOGRAPHIC CHARACTERIZATION AND CALIBRATION AGAINST SIMILAR OBSERVATIONS ON THE JOVIAN SATELLITES (PPR, NIMS)

EARTH SCIENCE OBJECTIVES

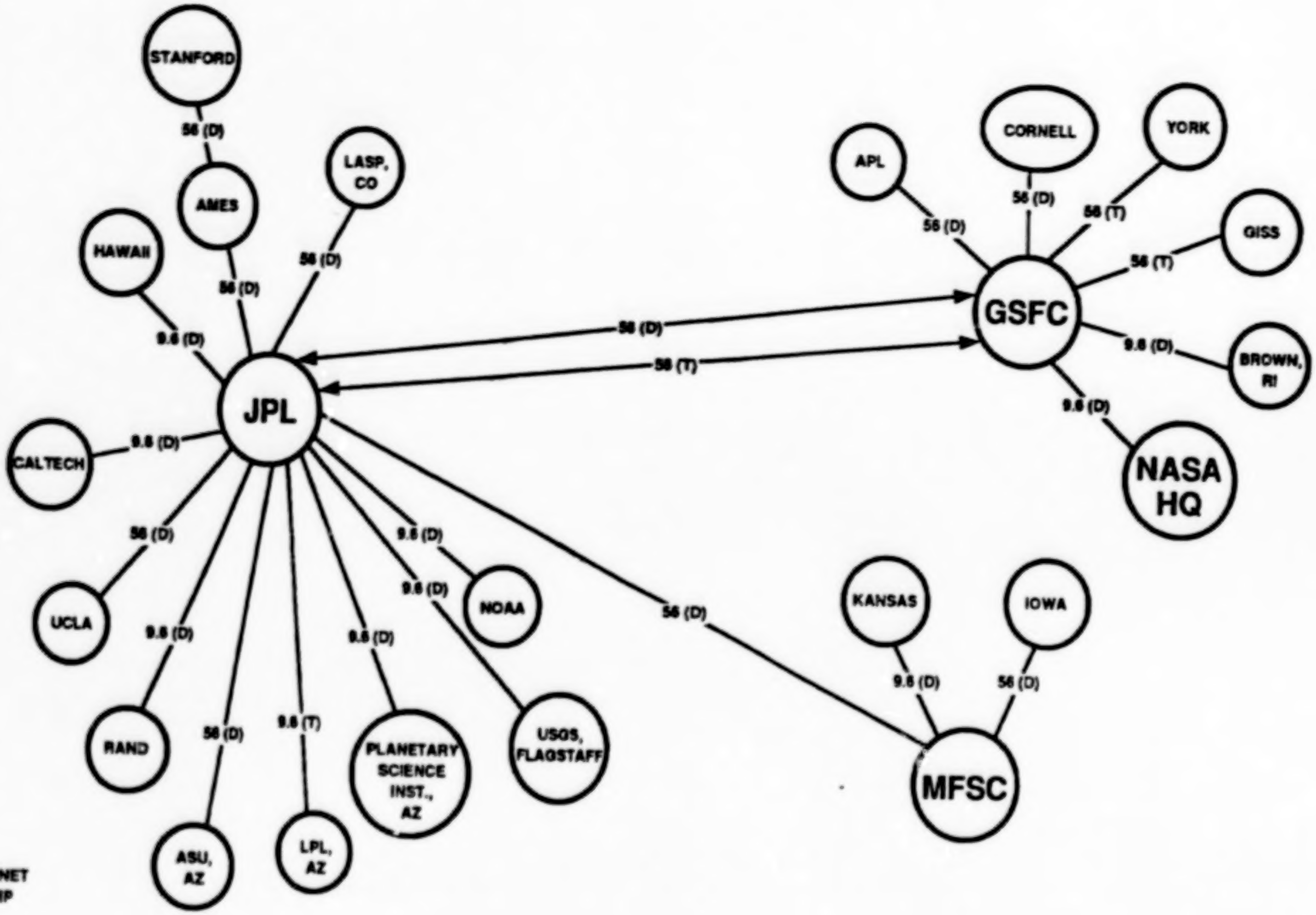
- GLOBAL MAPPING OF MESOSPHERIC WATER AND MESOSPHERIC CARBON DIOXIDE (NIMS)
- GLOBAL MAPPING OF METHANE AND OTHER "GREENHOUSE" GASES (NIMS)
- CHARACTERIZE DYNAMICS OF THE PLASMA ENVIRONMENT IN THE EARTH'S MAGNETOSPHERE AND MAGNETOTAIL (F&P)
- GROUND TRUTH SPATIAL RESOLUTION AND SPECTRAL MEASUREMENTS OF EARTH FEATURES FOR COMPARISON WITH OBSERVATIONS OF ASTEROIDS AND JOVIAN SATELLITES (SSI, NIMS)
- CHARACTERIZE HYDROGEN GEOTAIL (UVS)
- EARTH ATMOSPHERE AIRGLOW STUDIES (UVS)
- MEASURE MASS OF THE EARTH (RS)
- EARTH/MOON SYSTEM MOVIE, INBOUND TRAJECTORY LEG (SSI)
- 5 DAY EARTH ROTATION MOVIE, OUTBOUND TRAJECTORY LEG (SSI, NIMS, UVS, PPR)

SANTA 2 DATA FLOW


SFOC Backbone
B
Critical LAN
Multi-mission LAN
TEST LAN
Path to Bldg. 301
MO LAN
GLL LAN
MGN LAN
Critical LAN
Development LAN
1 WB input
IDC µVAX
IDC LAN
Auspex 8 GB NFS Server
X-Terminal
230-104
GLL MSA
Engr/DMD
Workstation
230-302
Pyramid
GIF4
(Shared with
VGR)
4-CPU
Solbourne
• TIS
• TDS
• PDB
• 4 GB Disk
GLL LAN
4-CPU Solbourne
• "EUA" Node
• TDS-EUA Server
• PDB Access
• DMD
NERT/DMD
Workstation
(HP/Apollo)
NTSC Scan
Converter
To Von Karman
L/L
Other
GLL
Workstations
SANTA LAN
TCP/IP and DECnet
Silicon Graphics
Cisco
Router
Channels 6T
and 5S
264-788
264-719
Silicon Graphics
NERT/DMD
Workstation
Cisco
Router
Silicon Graphics
264-235
ILAN
To rest
of world

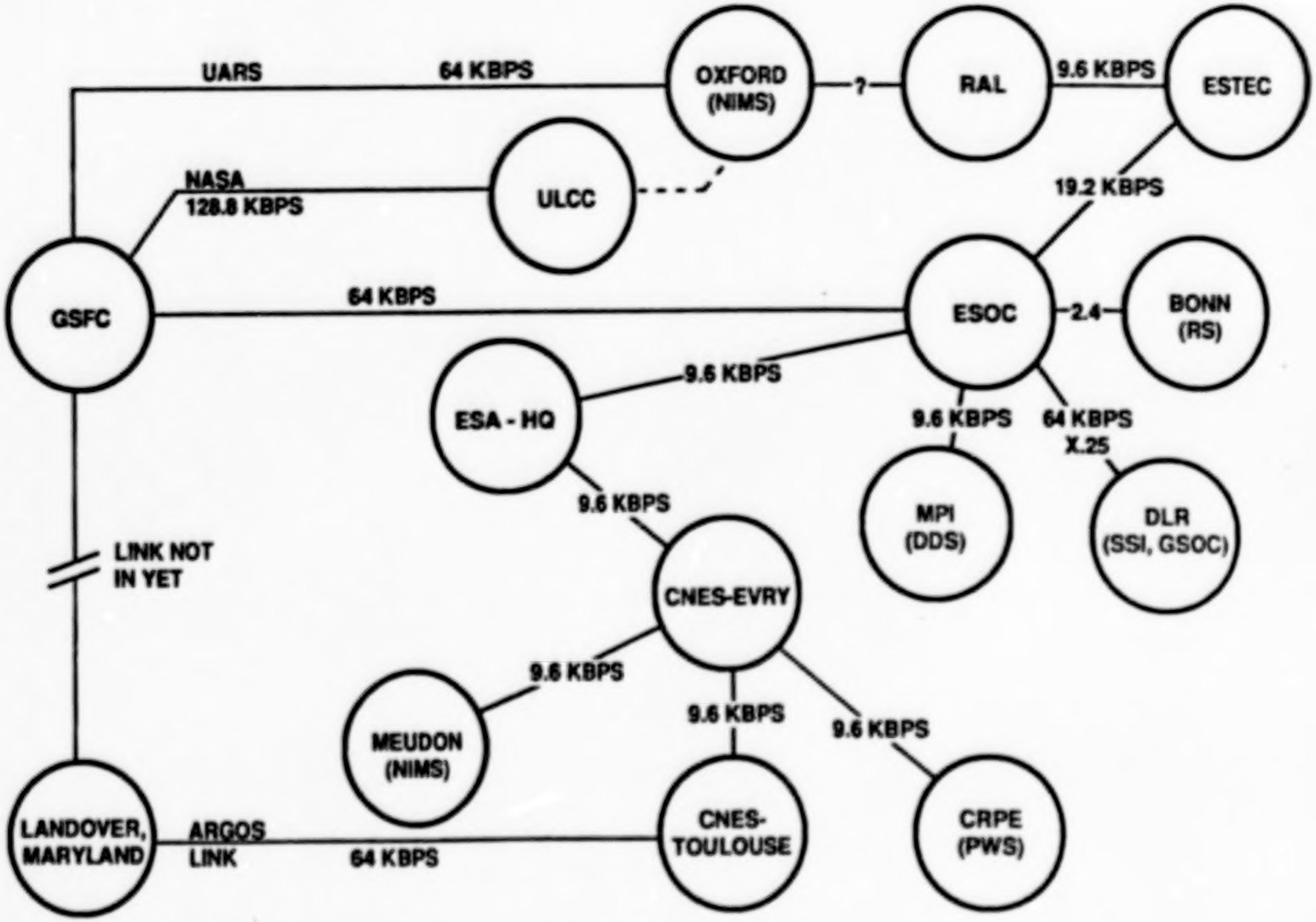
Bridge programmed to filter out all outgoing traffic except that going to the workstation in 230-104.

Galileo
THE U.S./CANADA CONNECTIONS


STANFORD
56 (D)
AMES
LASP, CO
56 (D)
HAWAII
56 (D)
9.6 (D)
JPL
CALTECH
9.6 (D)
56 (D)
UCLA
9.6 (D)
RAND
56 (D)
ASU, AZ
9.6 (T)
LPL, AZ
9.6 (D)
PLANETARY SCIENCE INST., AZ
9.6 (D)
9.6 (D)
NOAA
USGS, FLAGSTAFF
56 (D)
56 (D)
56 (T)
GSFC
APL
56 (D)
CORNELL
56 (D)
YORK
56 (T)
GISS
56 (T)
9.6 (D)
BROWN, RI
9.6 (D)
NASA HQ
KANSAS
IOWA
9.6 (D)
56 (D)
MFSC

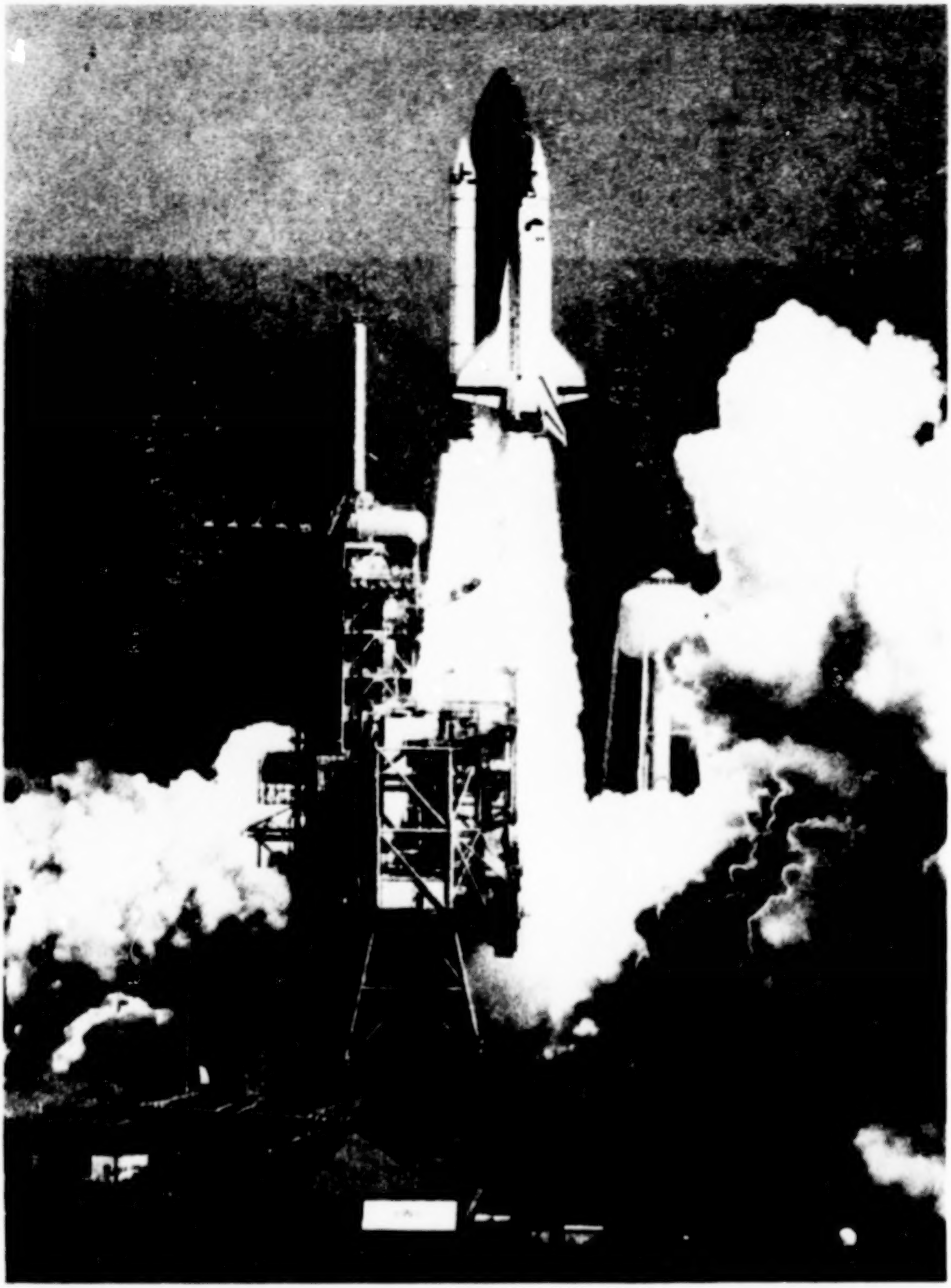
D = DECNET
T = TCP/IP

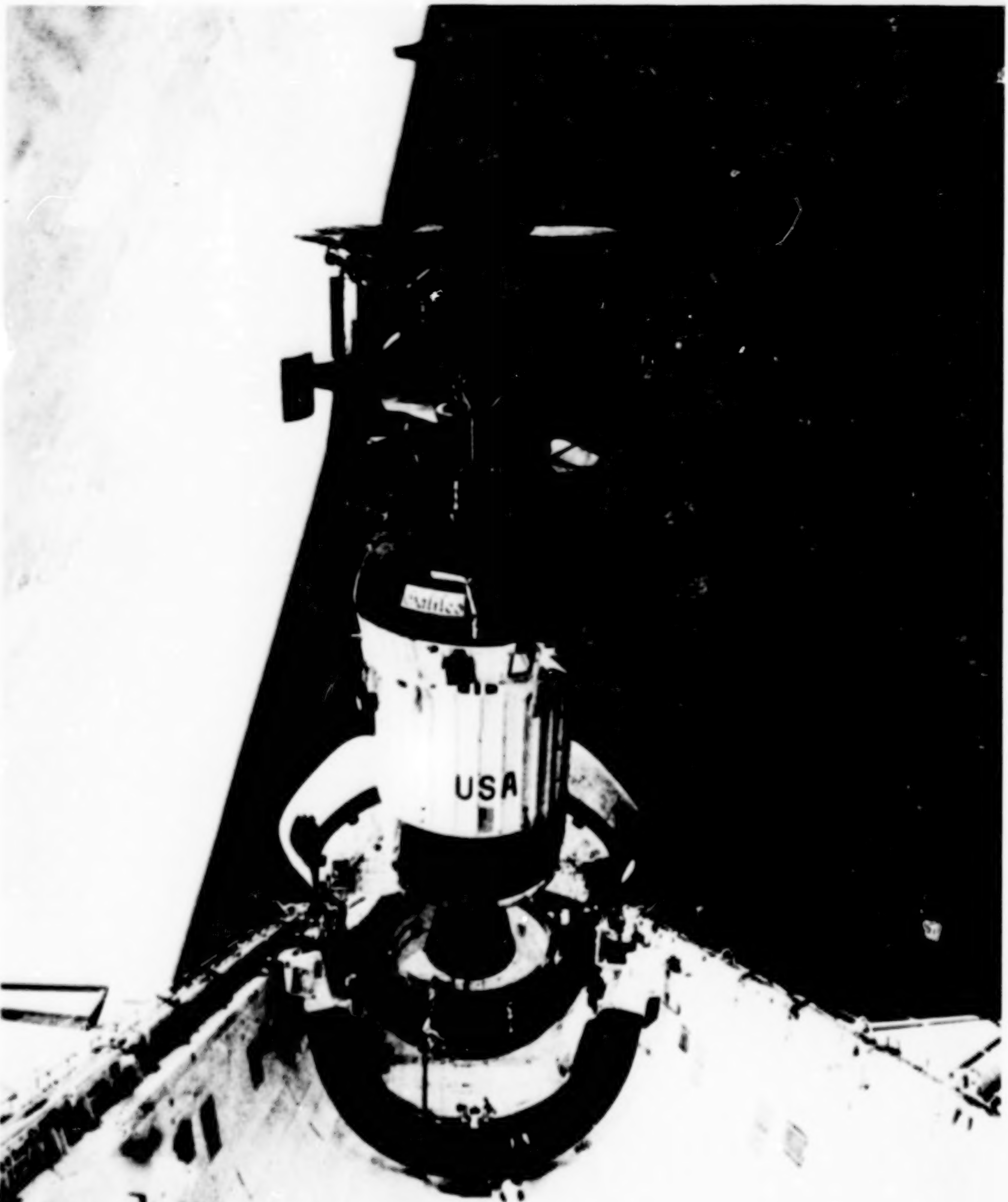
Galileo
THE EUROPEAN CONNECTIONS

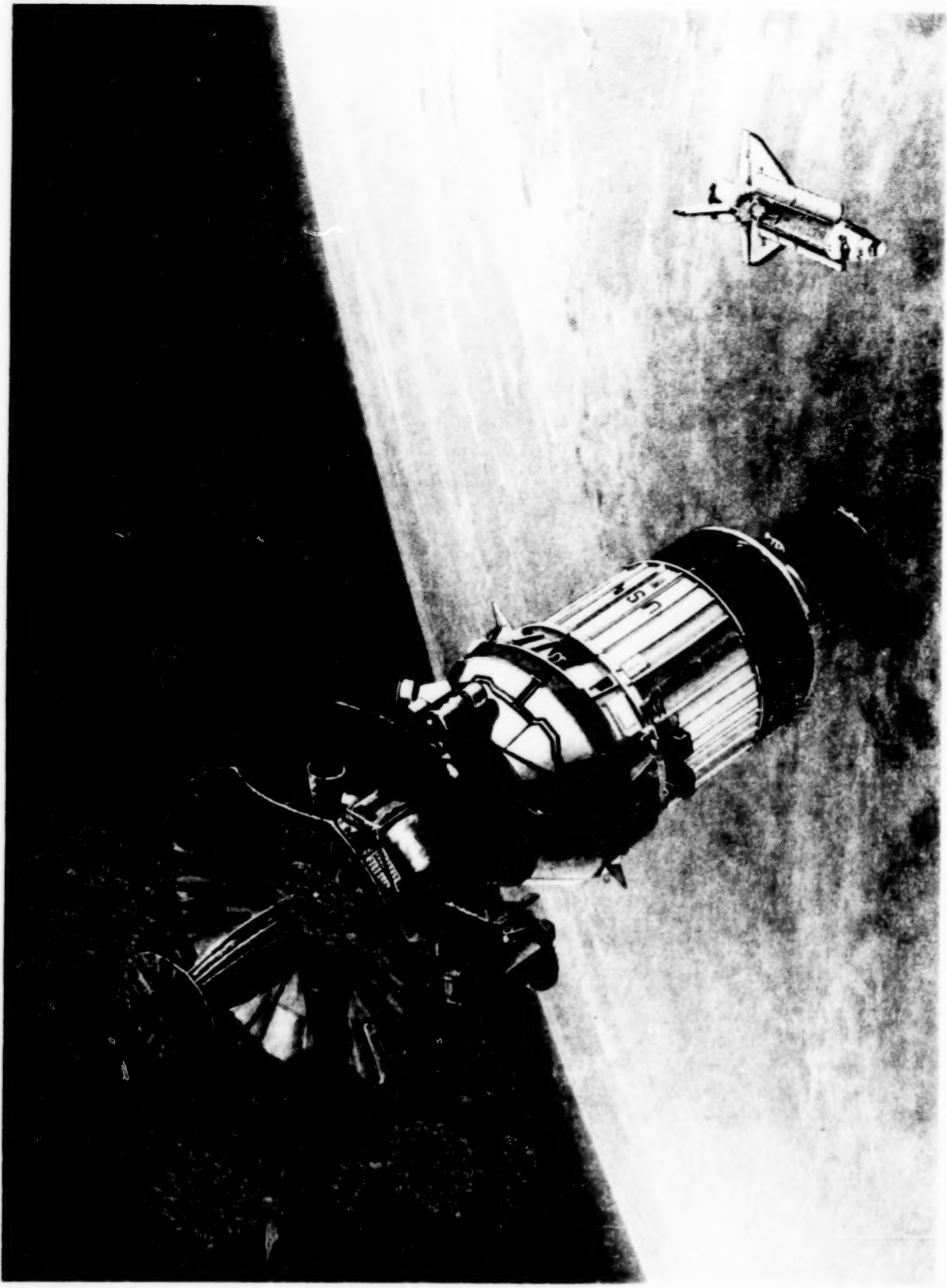


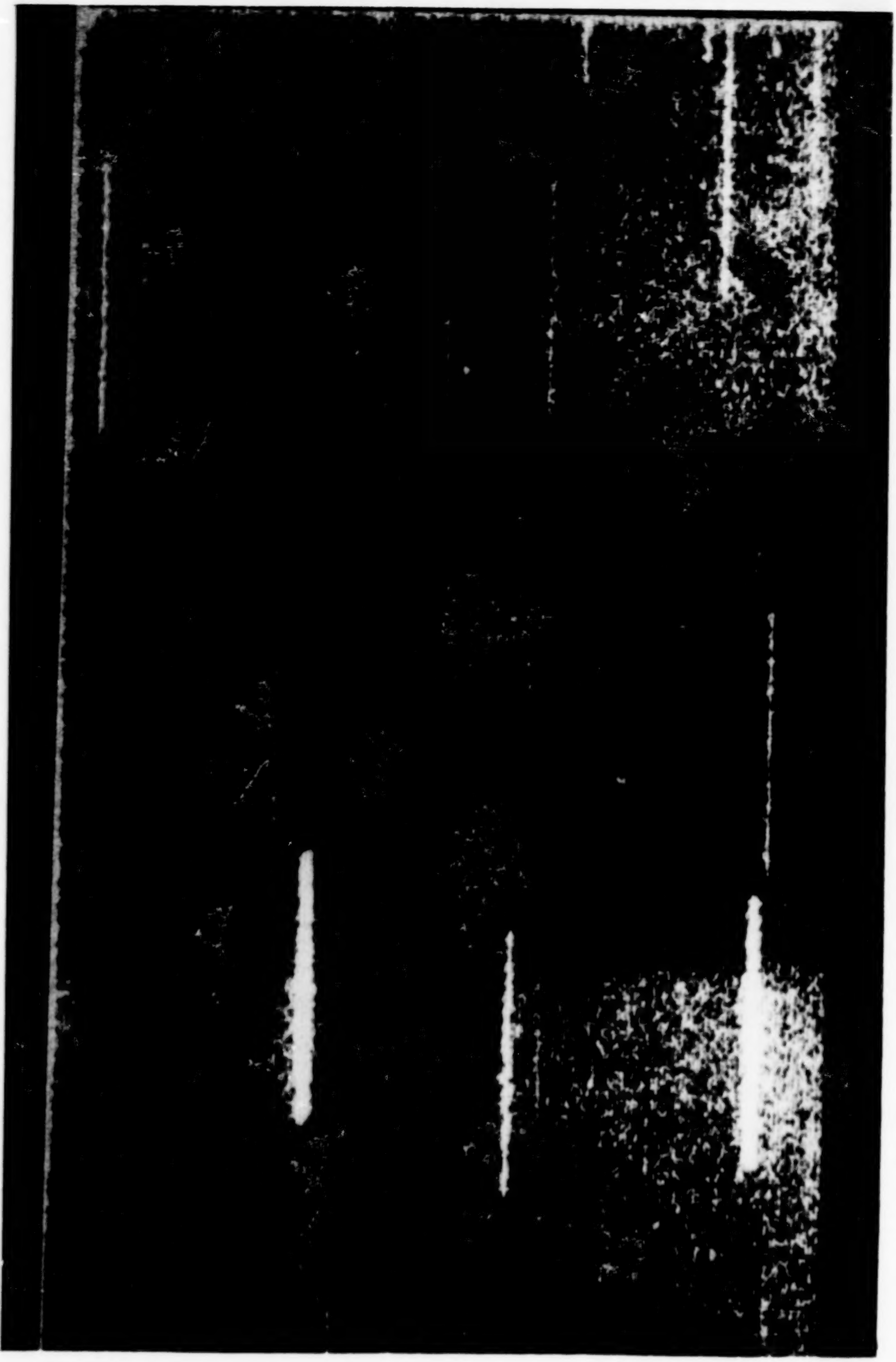
UARS
64 KBPS
OXFORD (NIMS)
?
RAL
9.6 KBPS
ESTEC
NASA
128.8 KBPS
ULCC
19.2 KBPS
GSFC
64 KBPS
ESOC
2.4
BONN (RS)
9.6 KBPS
ESA - HQ
9.6 KBPS
64 KBPS X.25
MPI (DDS)
DLR (SSI, GSOC)
9.6 KBPS
LINK NOT IN YET
CNES-EVRY
9.6 KBPS
MEUDON (NIMS)
9.6 KBPS
9.6 KBPS
LANDOVER, MARYLAND
ARGOS LINK
64 KBPS
CNES-TOULOUSE
CRPE (PWS)

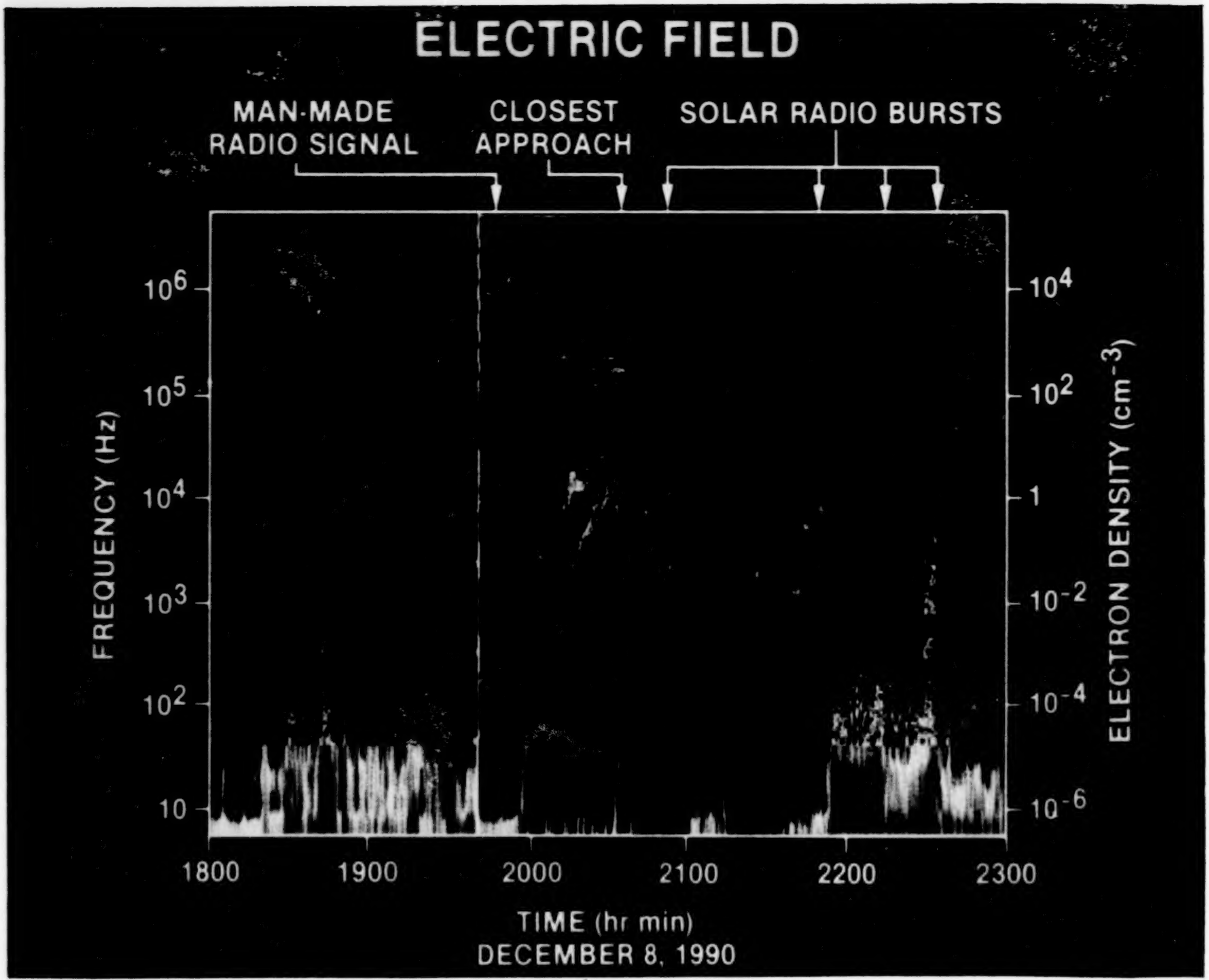
240



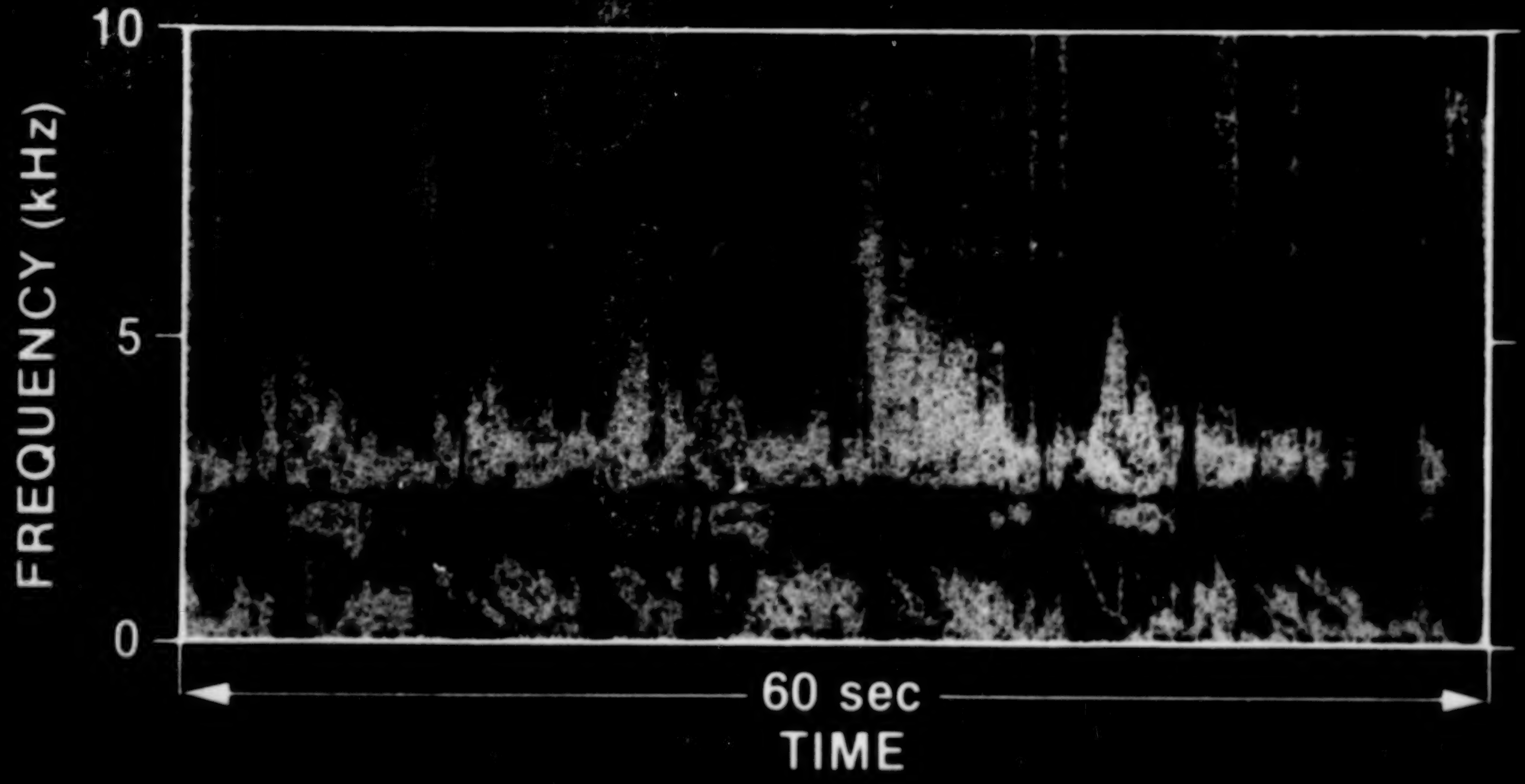

USA





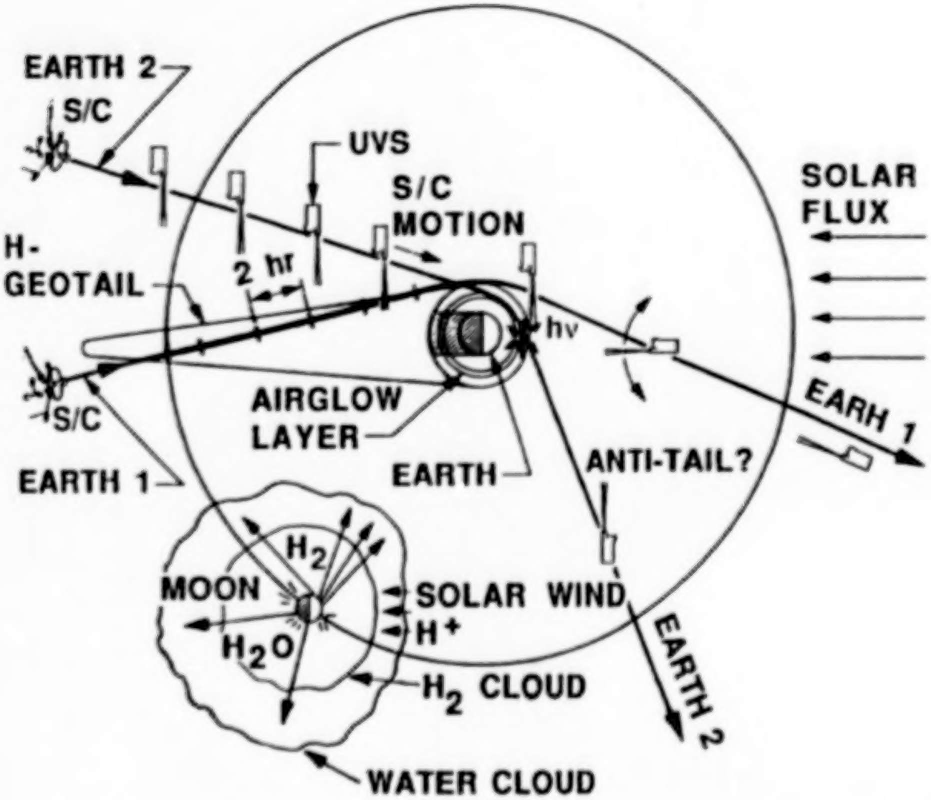

ELECTRIC FIELD
MAN-MADE RADIO SIGNAL
CLOSEST APPROACH
SOLAR RADIO BURSTS
FREQUENCY (Hz)
10^6
10^5
10^4
10^3
10^2
10
ELECTRON DENSITY (cm^{-3})
10^4
10^2
1
10^{-2}
10^{-4}
10^{-6}
1800
1900
2000
2100
2200
2300
TIME (hr min)
DECEMBER 8, 1990

LIGHTNING WHISTLERS

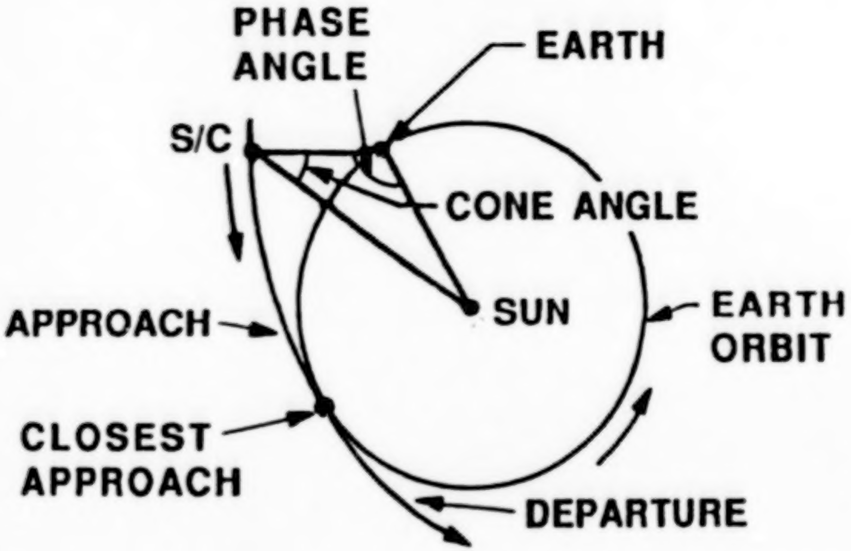


ULTRAVIOLET SPECTROMETER OBSERVATIONS DURING CLOSE ENCOUNTER PERIODS

- H GEOTAIL
- INTERACTION OF SOLAR WIND WITH H AT THE MOON ⟶ H_2
- COMETESIMAL CAUSED H_2O CLOUD DIFFUSING FROM THE MOON
- ANTI-TAIL

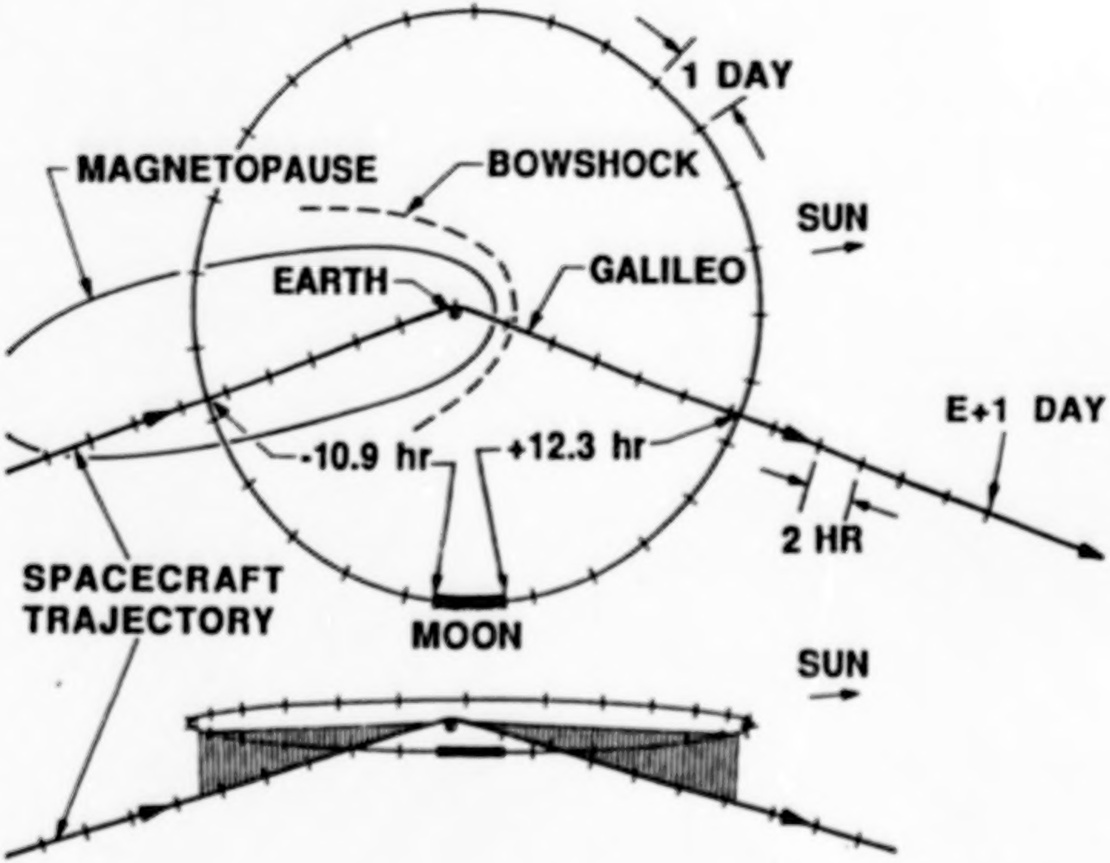

EARTH 2
S/C
UVS
S/C MOTION
SOLAR FLUX
H-GEOTAIL
2 hr
hν
AIRGLOW LAYER
EARTH
ANTI-TAIL?
EARH 1
S/C
EARTH 1
H_2
MOON
SOLAR WIND
H^+
H_2O
H_2 CLOUD
WATER CLOUD
EARTH 2

PHASE ANGLE AND CONE ANGLE OF THE EARTH DURING THE EARTH ENCOUNTERS

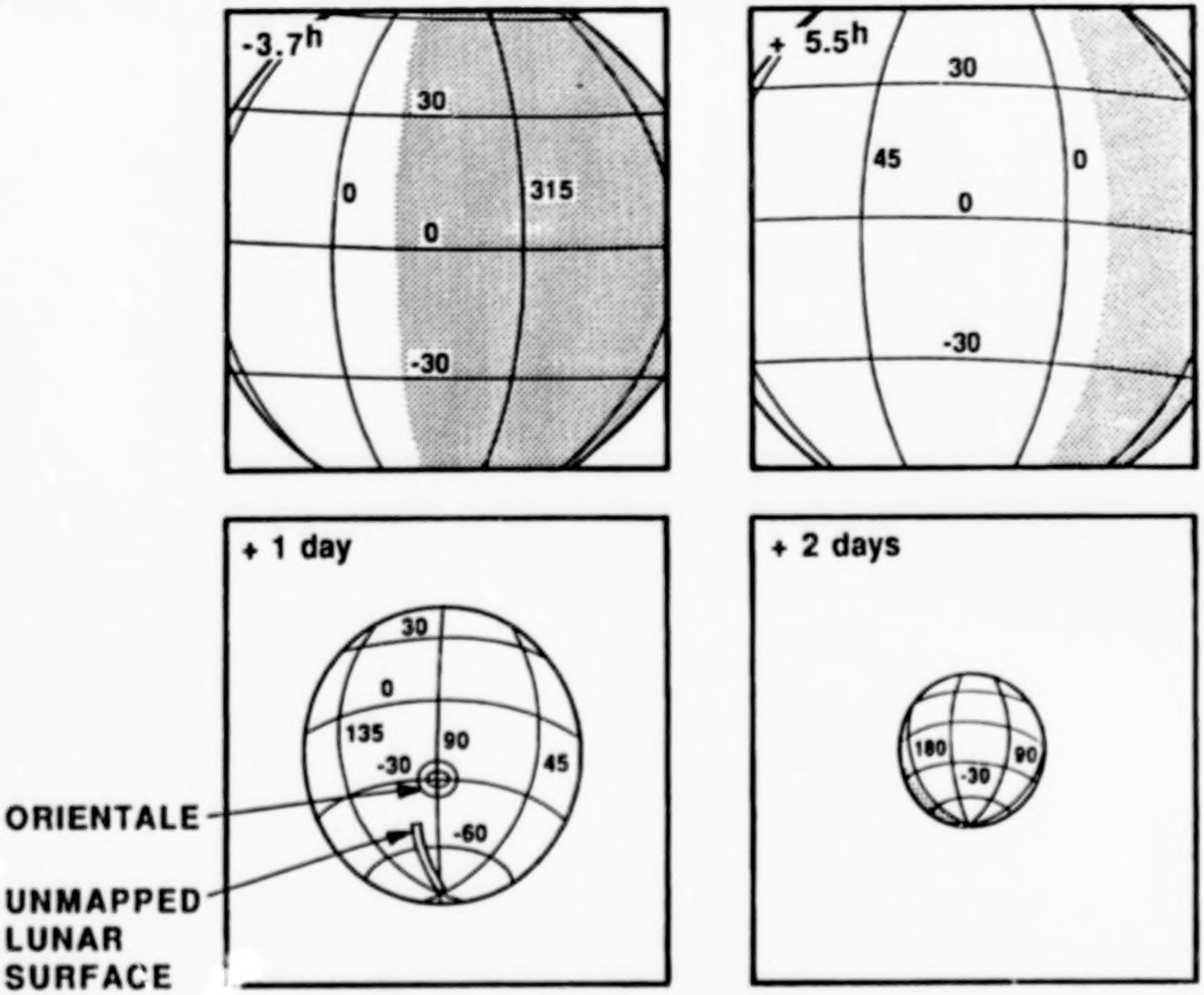

PHASE ANGLE
EARTH
S/C
CONE ANGLE
SUN
EARTH ORBIT
APPROACH
CLOSEST APPROACH
DEPARTURE

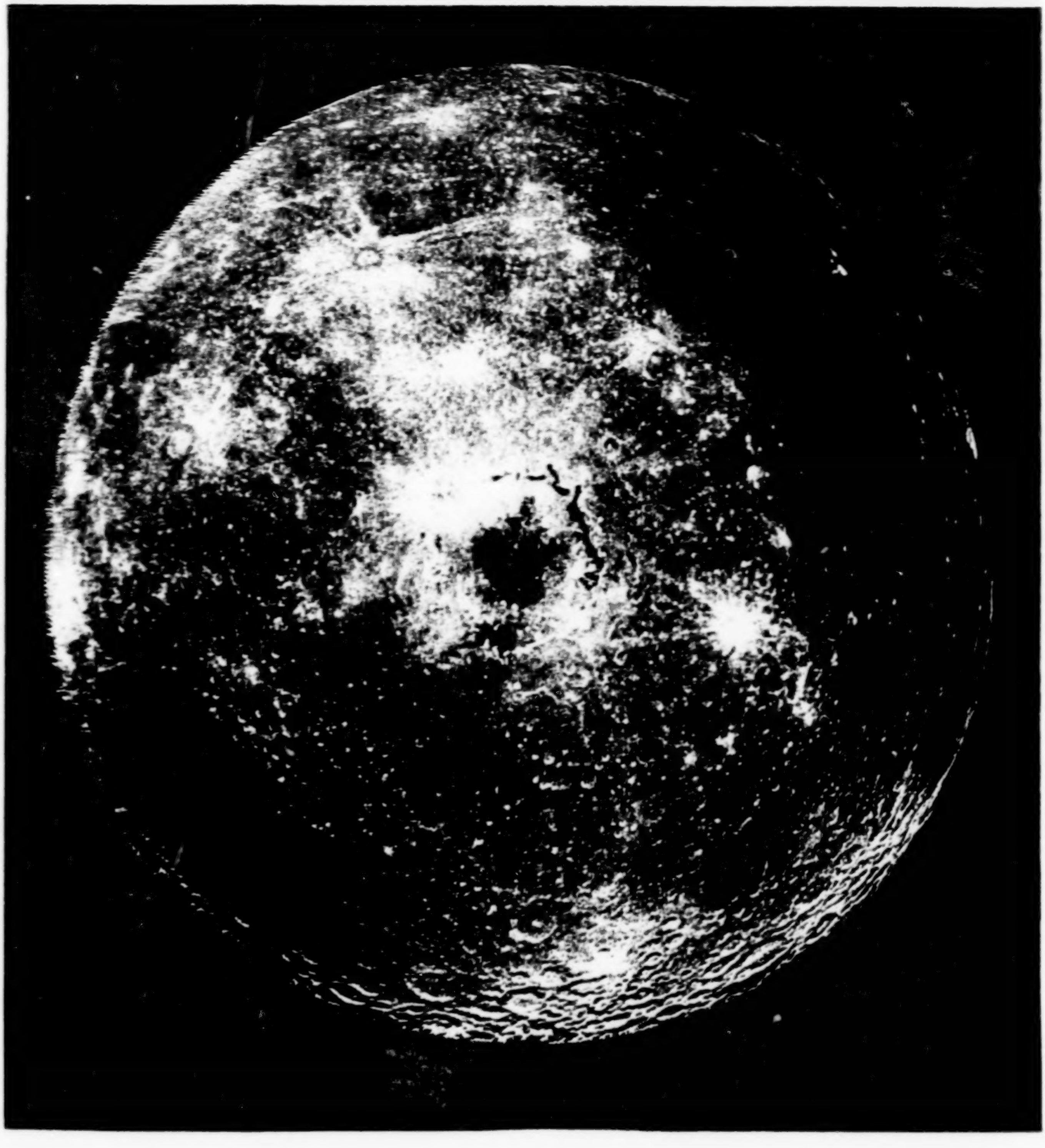
- DARKSIDE (HIGH PHASE ANGLE) APPROACH
- TERMINATOR CROSSING AT CLOSEST APPROACH
- LIGHTSIDE (LOW PHASE ANGLE) DEPARTURE
- CLOSING RATE ~ 750,000 KM/DAY
- SUN POINTED SPACECRAFT REQUIRES USE OF LOW GAIN ANTENNAS

LUNAR ORBIT TRAVERSE AT EGA1


1 DAY
MAGNETOPAUSE
BOWSHOCK
SUN
EARTH
GALILEO
E+1 DAY
-10.9 hr
+12.3 hr
2 HR
SPACECRAFT TRAJECTORY
MOON
SUN

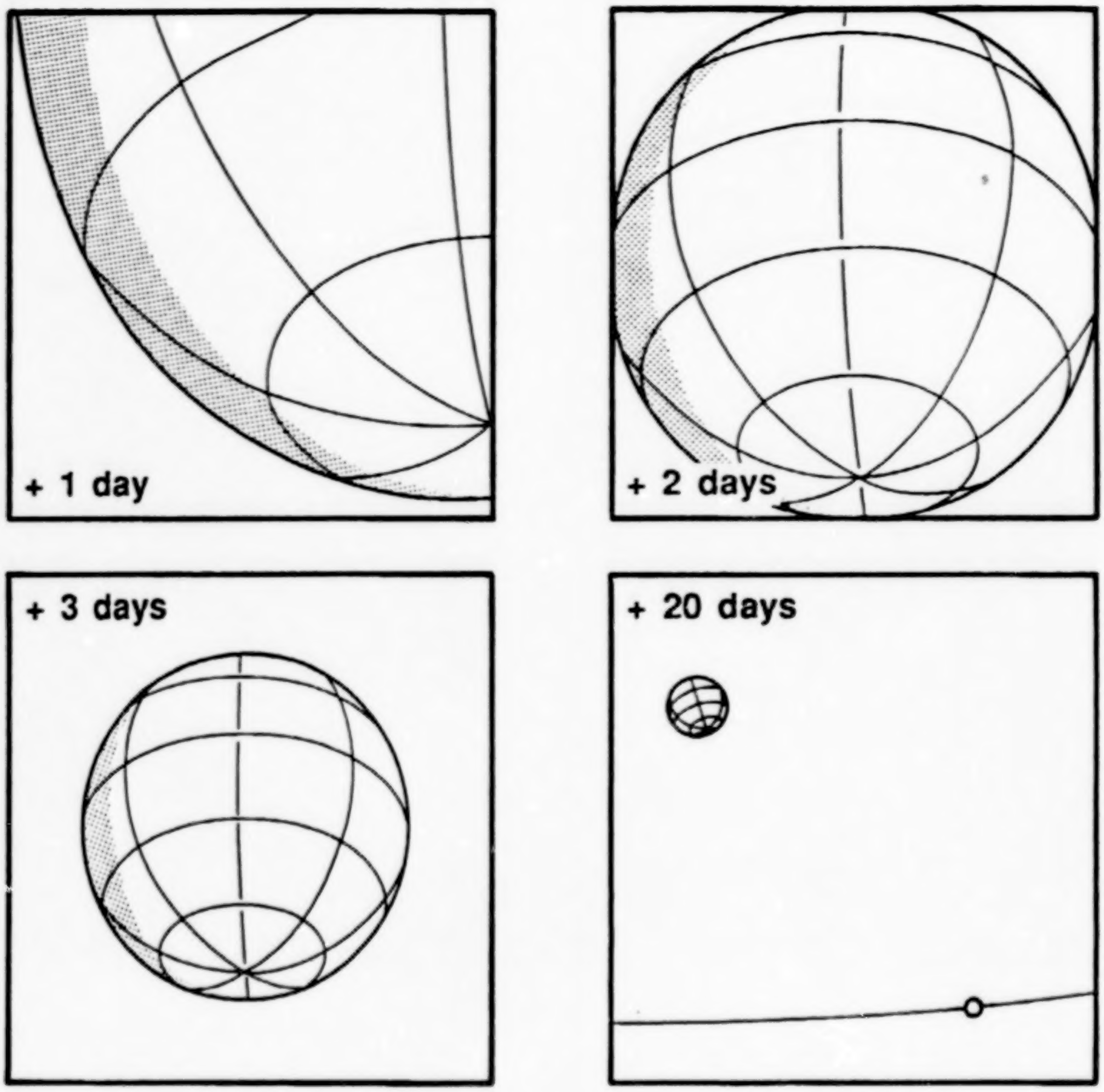
MOON IMAGING – EGA 1

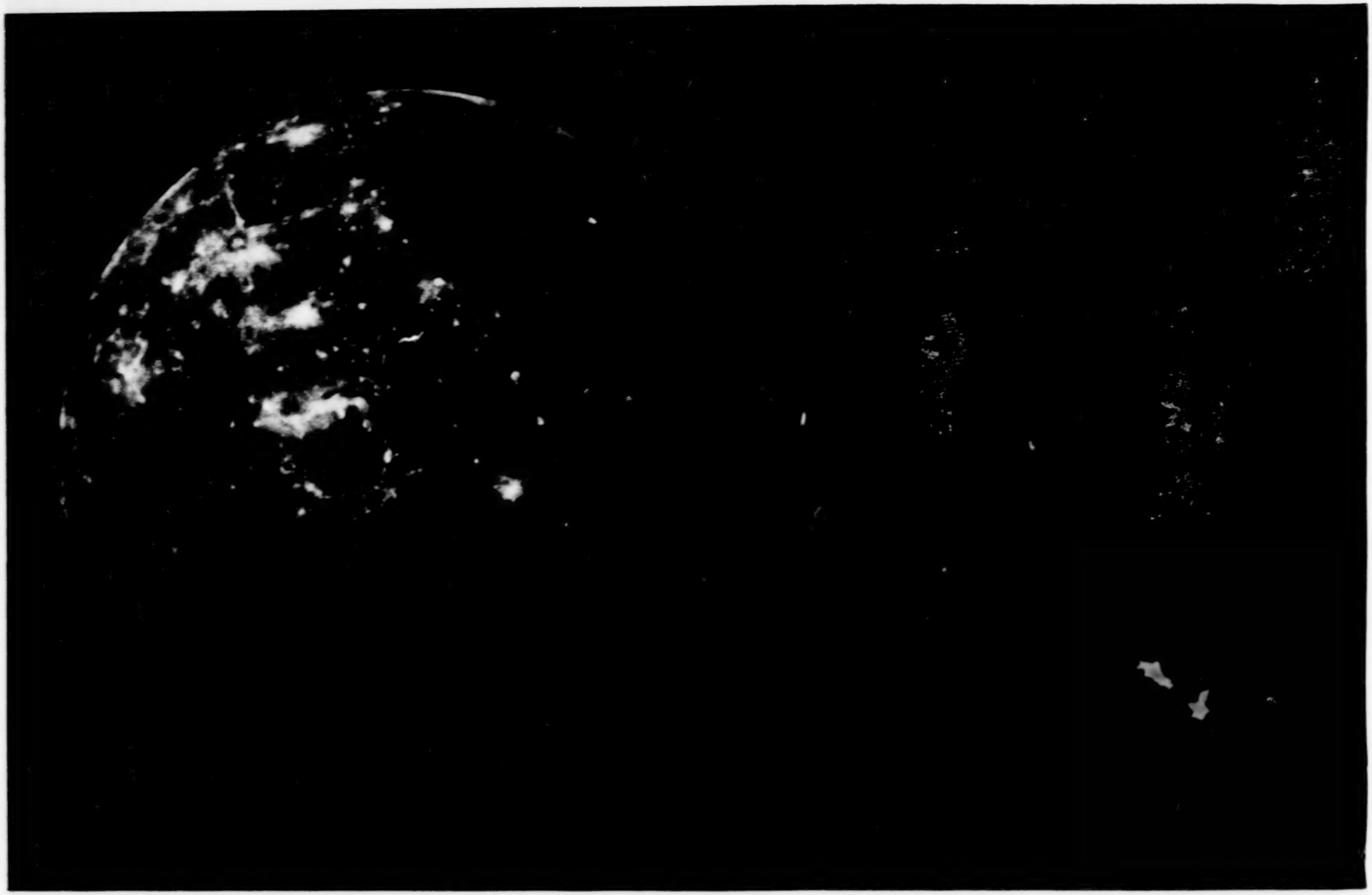

-3.7h
30
0
315
0
-30
+ 5.5h
30
45
0
0
-30
+ 1 day
30
0
135
90
-30
45
-60
ORIENTALE
UNMAPPED LUNAR SURFACE
+ 2 days
180
90
-30



This image of the western hemisphere of the Moon was taken through a green filter by the Galileo spacecraft at 9:35 a.m. PST Dec. 9 at a range of about 350,000 miles. In the center is the Orientale Basin, 600 miles in diameter, formed about 3.8 billion years ago by the impact of an asteroid-size body. Orientale's dark center is a small mare. To the right is the lunar near side with the great, dark Oceanus Procellarum above and the small, circular, dark Mare Humorum below. Maria are broad plains formed mostly over 3 billion years ago as vast basaltic lava flows. To the left is the lunar far side with fewer maria, but, at lower left, the South-Pole-Aitken basin, about 1200 miles in diameter, which resembles Orientale but is much older and more weathered and battered by cratering. The intervening cratered highlands of both sides, as well as the maria, are dotted with bright, young craters. This image was "reprojected" so as to center the Orientale Basin, and was filtered to enhance the visibility of small features. The digital image processing was done by DLR, the German Aerospace Research Establishment near Munich, an international collaborator in the Galileo mission.

GALILEO IMAGING EARTH AFTER EGA 1

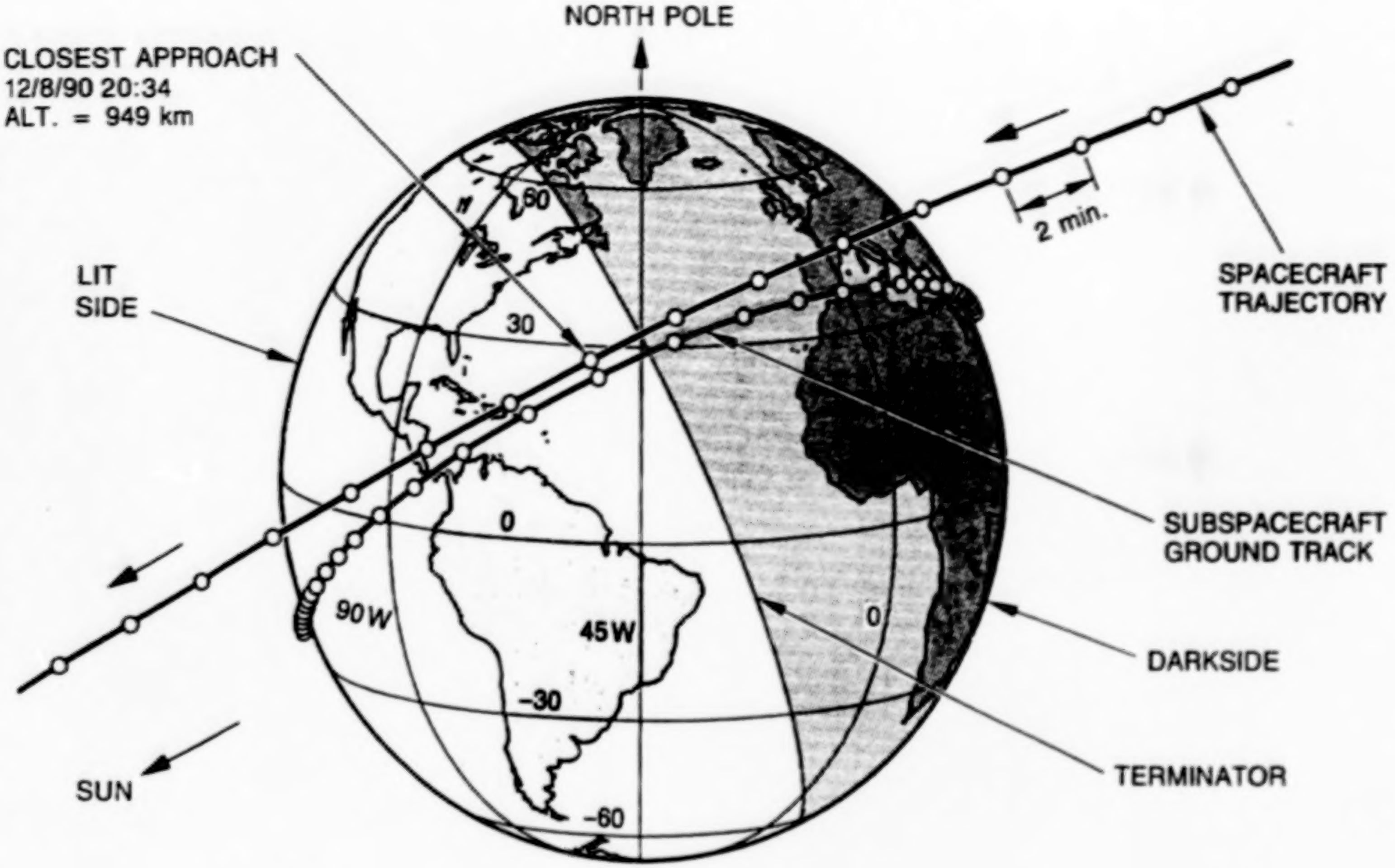

+ 1 day
+ 2 days
+ 3 days
+ 20 days

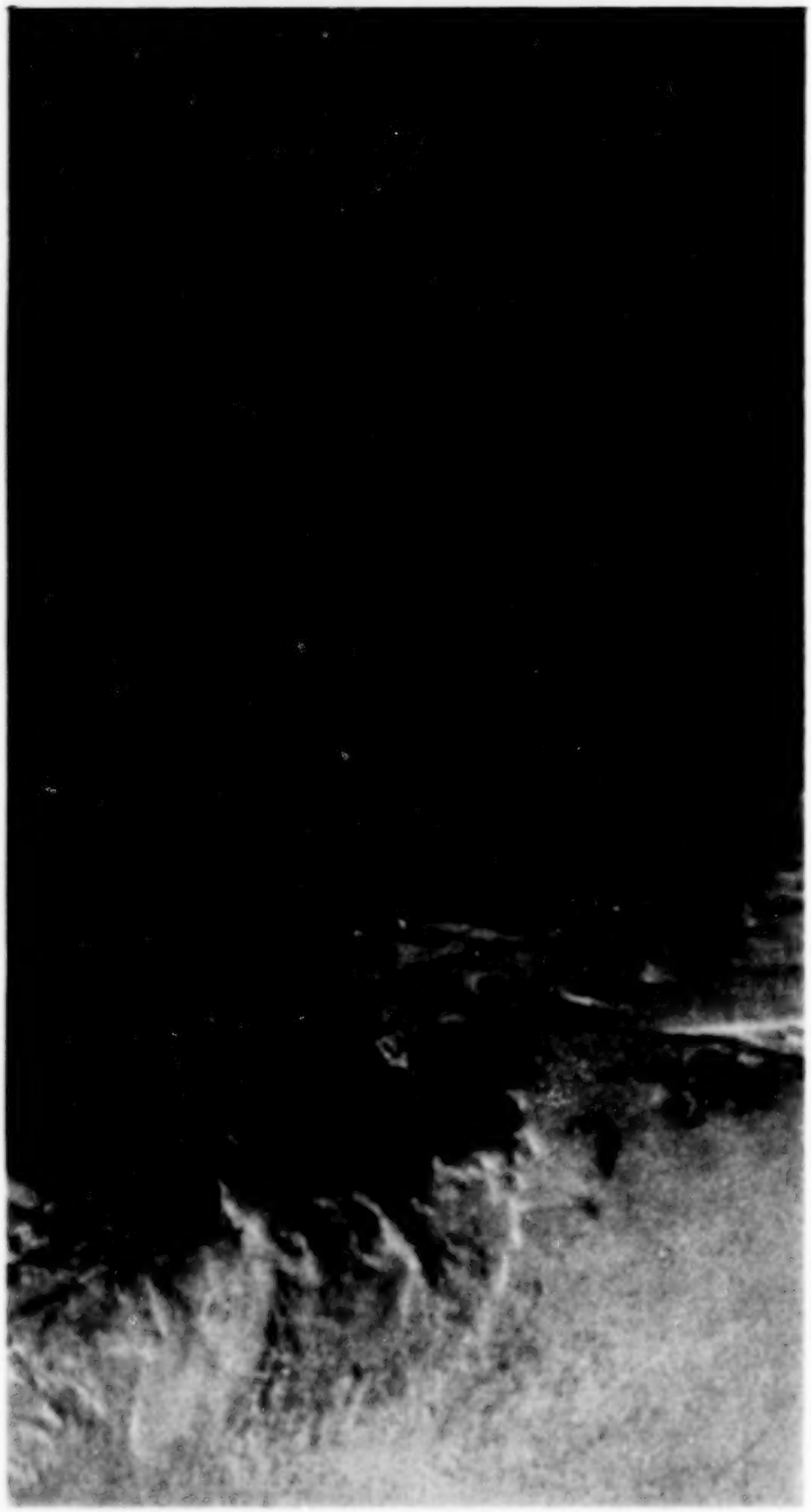


These pictures of the Moon were taken by the Galileo spacecraft at (right photo) 6:47 p.m. PST Dec 8, 1990 from a distance of almost 220,000 miles, and at (left photo) 9:35 a.m. PST Dec 9, 1990 at a range of more than 350,000 miles. The picture on the right shows the dark Oceanus Procellarum in the upper center, with Mare Imbrium above it and the smaller circular Mare Humorum below. The Orientale Basin, with a small mare in its center, is on the lower left near the limb or edge. Between stretches the cratered highland terrain, with scattered bright young craters on highlands and maria alike. The picture at left shows the globe of the Moon rotated, putting Mare Imbrium on the eastern limb and moving the Orientale Basin almost to the center. The extent of the cratered highlands on the far side is very apparent. At lower left, near the limb, is the South-Pole-Aitken basin, similar to Orientale but very much older and some 1,200 miles in diameter. This feature was previously known as a large depression in the southern far side; this image shows its Orientale-like structure and darkness relative to surrounding highlands.

Galileo

EARTH 1 FLYBY GEOMETRY


NORTH POLE
CLOSEST APPROACH
12/8/90 20:34
ALT. = 949 km
2 min.
SPACECRAFT TRAJECTORY
LIT SIDE
60
30
0
-30
-60
90 W
45 W
0
SUBSPACECRAFT GROUND TRACK
DARKSIDE
TERMINATOR
SUN



This color picture of Antarctica is one part of a mosaic of pictures covering the entire polar continent taken during the hours following Galileo's historic first encounter with its home planet. The view shows the Ross Ice Shelf to the right and its border with the sea. An occasional mountain can be seen poking through the ice near the McMurdo Station. It is late spring in Antarctica, so the sun never sets on the frigid, icy continent. This picture was taken about 6:20 p.m. PST on December 8, 1990. From top to bottom, the frame looks across about half of Antarctica.

E. Networking Subgroup Presentations

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NASA/SPAN AND DOE/ESNET-DECNET TRANSITION STRATEGY FOR DECNET OSI/PHASE V

Linda Porter and Phil DeMar*

Space Science Laboratory
National Aeronautics And Space Administration
George C. Marshall Space Flight Center
Huntsville, Alabama

MSFC - Cover 32 (Rev. November 1985)

NASA/SPAN AND DOE/ESNET-DECNET TRANSITION STRATEGY FOR DECNET OSI/PHASE V

Linda Porter, NASA/Marshall Space Flight Center
Phil DeMar, DOE/Fermi National Accelerator Laboratories

ABSTRACT

This paper examines the technical issues involved with the transition of very large DECnet networks from DECnet Phase IV protocols to DECnet OSI/Phase V protocols. The networks involved are the National Aeronautics and Space Administration's Science Internet (NSI-DECnet) and the Department Of Energy's (DOE's) Energy Sciences network (ESnet-DECnet). These networks, along with the many universities and research institutions connected to them, combine to form a single DECnet network containing more than 20,000 nodes and crossing numerous organizational boundaries. The transition planning for this network must deal with both the scale of the network and its administrative complexity. This necessitates creation of a transition strategy that is flexible enough to allow different parts of the network to upgrade to Phase V at different times, yet is sufficiently coordinated so that network functions are not disrupted.

Discussion of transition planning, including decisions about Phase V naming, addressing, and routing are presented. Also discussed are transition issues related to the use of non-DEC routers in the network.

INTRODUCTION

The DECnet Internet is a very large DECnet-based network reaching government, university and research sites throughout the world which are involved in scientific research. The network has grown from numerous small, disconnected DECnet networks of 10 years ago to a conglomerate network which crosses numerous international and organizational boundaries. The DECnet Internet, therefore, is not an "engineered" network, rather, it is the result of the growth and interconnection between a number of smaller, previously independent DECnet networks.

The four largest participants in the DECnet Internet are the NSI-DECnet (formerly SPAN), the ESnet-DECnet, the European Space Agency's Space Physics Analysis Network (E-SPAN) and the consortium of European High-Energy Physics Research Institutions (E-HEPnet). Other participants include scientific DECnet networks in Japan, Canada, South America, and Australia. Administratively separate, these DECnet networks share a common address space and lie within a single routing domain. The result is a single huge DECnet network of thousands of nodes, complicated architecture and many network managers.

In the U.S., the NSI-DECnet and the ESnet-DECnet comprise the bulk of the DECnet Internet systems:

- o The NSI-DECnet is a NASA-funded network supporting space plasma physics and astrophysics as well as related space science research programs. NSI-DECnet reaches more than 80 sites, including most of the NASA field centers and universities that are involved in NASA research programs. The network also has connections to other DECnet networks throughout the world that engage in space science research and programs (Figure 1).
- o The ESnet-DECnet is a DOE-funded network supporting energy research programs such as high energy physics, nuclear physics, and fusion research. It connects together over 60 sites in the United States, including the major national laboratories, as well as universities involved in energy research programs. The ESnet-DECnet, like the NSI-DECnet, supports numerous connections to other DECnet networks around the world involved in energy research (Figure 2).

The network management teams for the four major participant networks coordinate operations through the "HEP-SPAN DECnet Coordinating Group", or HSDCG, to ensure the network functions properly. The HSDCG is involved in coordinating technical issues such as address usage and circuit cost assignments (routing), as well as administrative issues such as security incident handling and network information distribution. The primary task now facing the group is planning for the transition of DECnet Phase IV protocols in use on the network today to DECnet OSI/Phase V.

Complicating the planning for implementing Phase V on the DECnet Internet are the numerous interconnections (dashed lines) between the networks (Figure 3). These interconections were originally installed to serve specific program or research requirements rather than improve overall network performance. There are no less than 17 interconnections between NSI-DECnet and ESnet-DECnet in the U.S. Although these links provide redundancy, they also add many routers to the network, making the routing topology very complicated and the transition planning more difficult. As we'll see later on, routers are key elements in the transition.

This paper deals with the major issues involved in planning for the transition to DECnet OSI/Phase V, primarily from the perspective of the NSI-DECnet and ESnet-DECnet networks. First we examine the motivations behind the requirement to use Phase V protocols. Next we present constraints on the transition planning, including a discussion on maintaining Phase IV connectivity and implementing OSI protocols for the anticipated future network environment. We then outline the general transition strategy for the DECnet Internet. Finally, we present a technical discussion of OSI/Phase V addressing, naming and routing issues.

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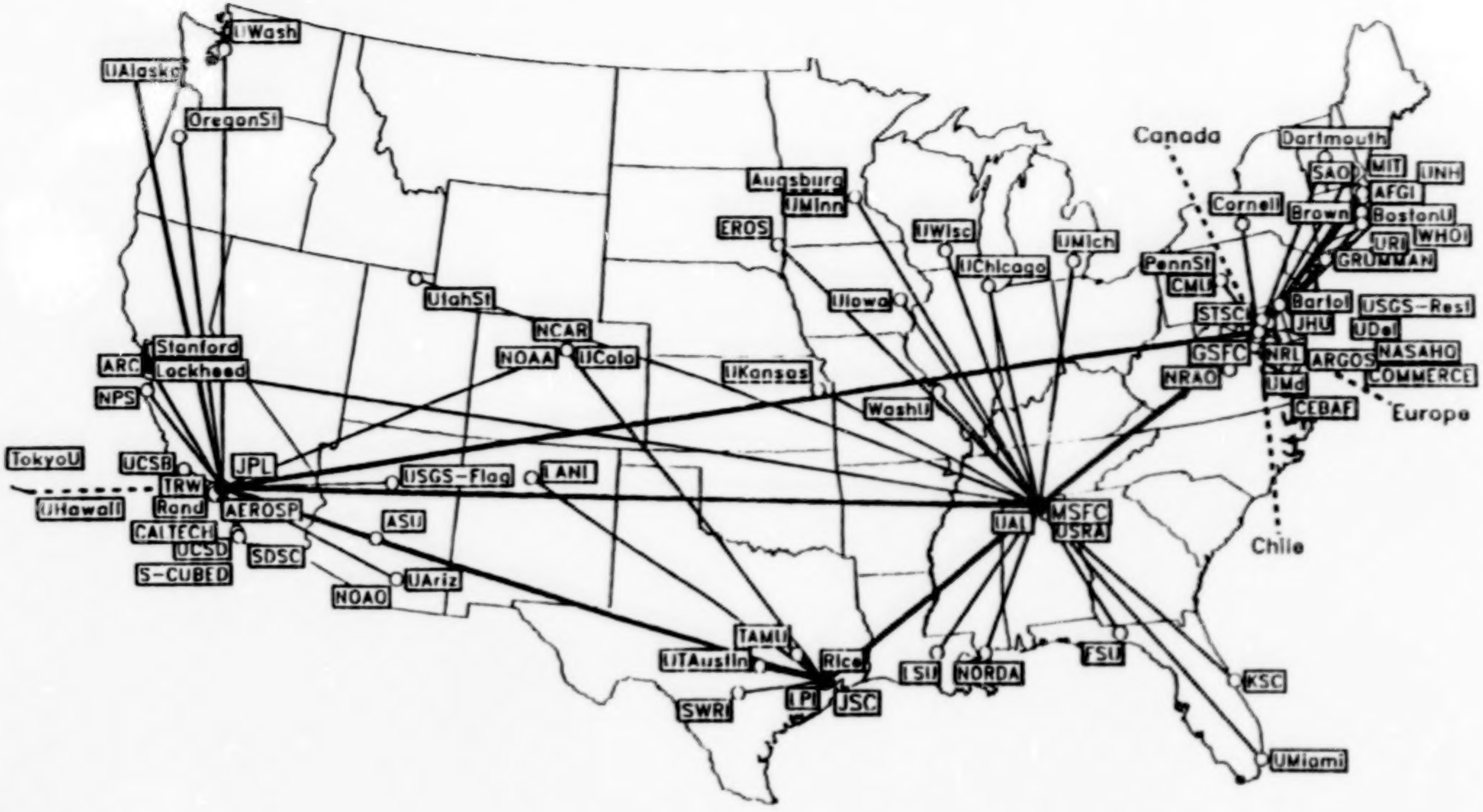
NSI / Space Physics Analysis Network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CALTECH
UCSD
SDSC
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ASU
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MSFC
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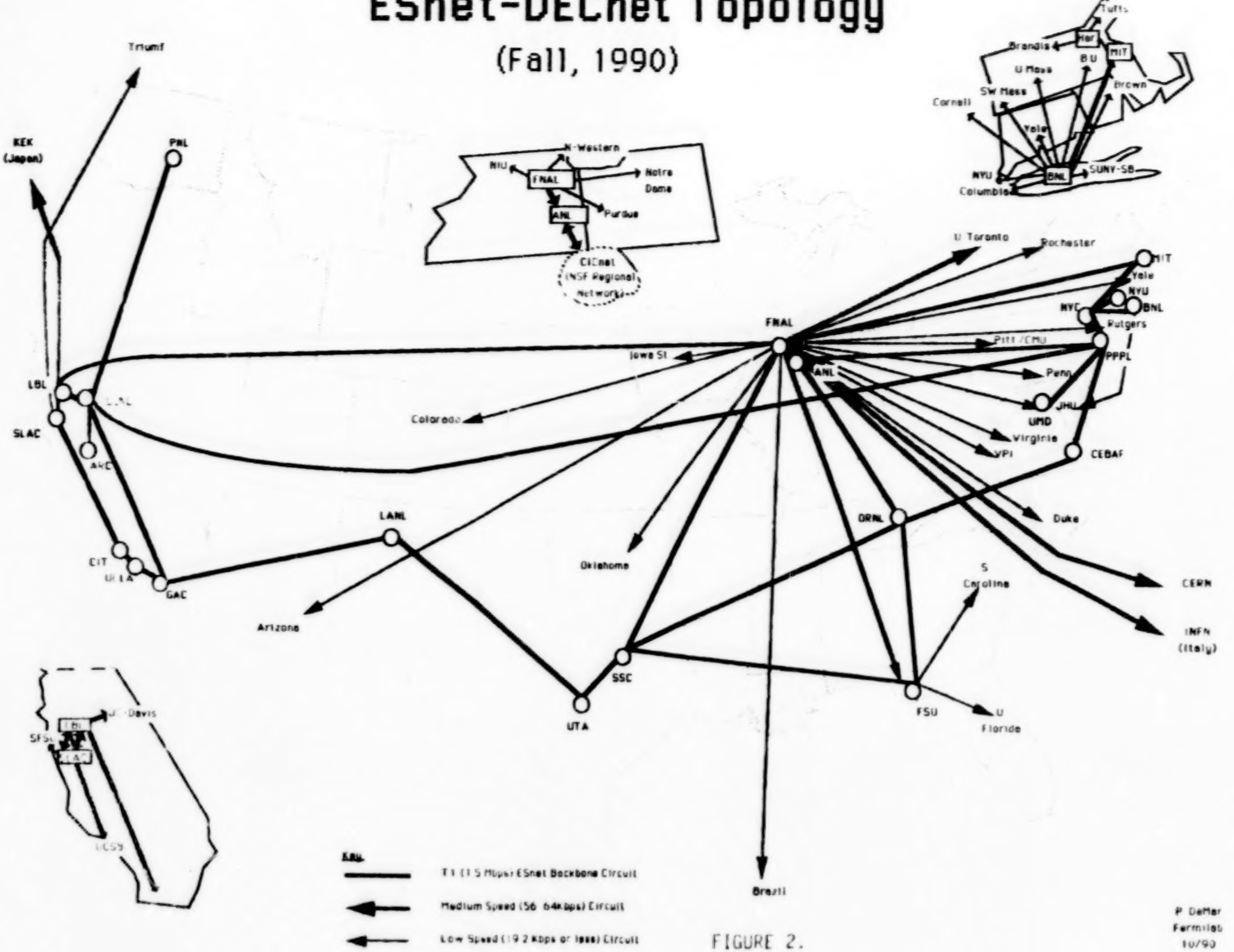
USRA
Chile
TAMU
UTAustin
Rice
LPI
JSC
SWRI
LSU
NORDA
FSU
KSC
UMiami

FIGURE 1.

Prepared for: NASA Science Internet Project Office
by: Sterling Software, NAS2-11555
March 1, 1990

ESnet-DECnet Topology

(Fall, 1990)



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KEK
(Japan)
PNL
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Colorado
Iowa St
Oklahoma
FNAL
ANL
ORNL
FSU
U Florida
S Carolina
Brazil
CEBAF
Duke
CERN
INFN (Italy)
VPI
Virginia
UMD
JHU
Penn
PPPL
Pitt/CMU
Rutgers
NYC
NYU
BNL
Yale
MIT
Rochester
U Toronto
NIU
N-Western
Notre Dame
Purdue
CICnet (NSF Regional Network)
Tufts
Brandis
Har
MIT
BU
U Mass
SW Mass
Brown
Cornell
Yale
NYU
BNL
SUNY-SB
Columbia
UC-Davis
LBL
SFSU
SLAC
UCSB
Key
T1 (1.5 Mbps) ESnet Backbone Circuit
Medium Speed (56 64kbps) Circuit
Low Speed (19.2 Kbps or less) Circuit

FIGURE 2.

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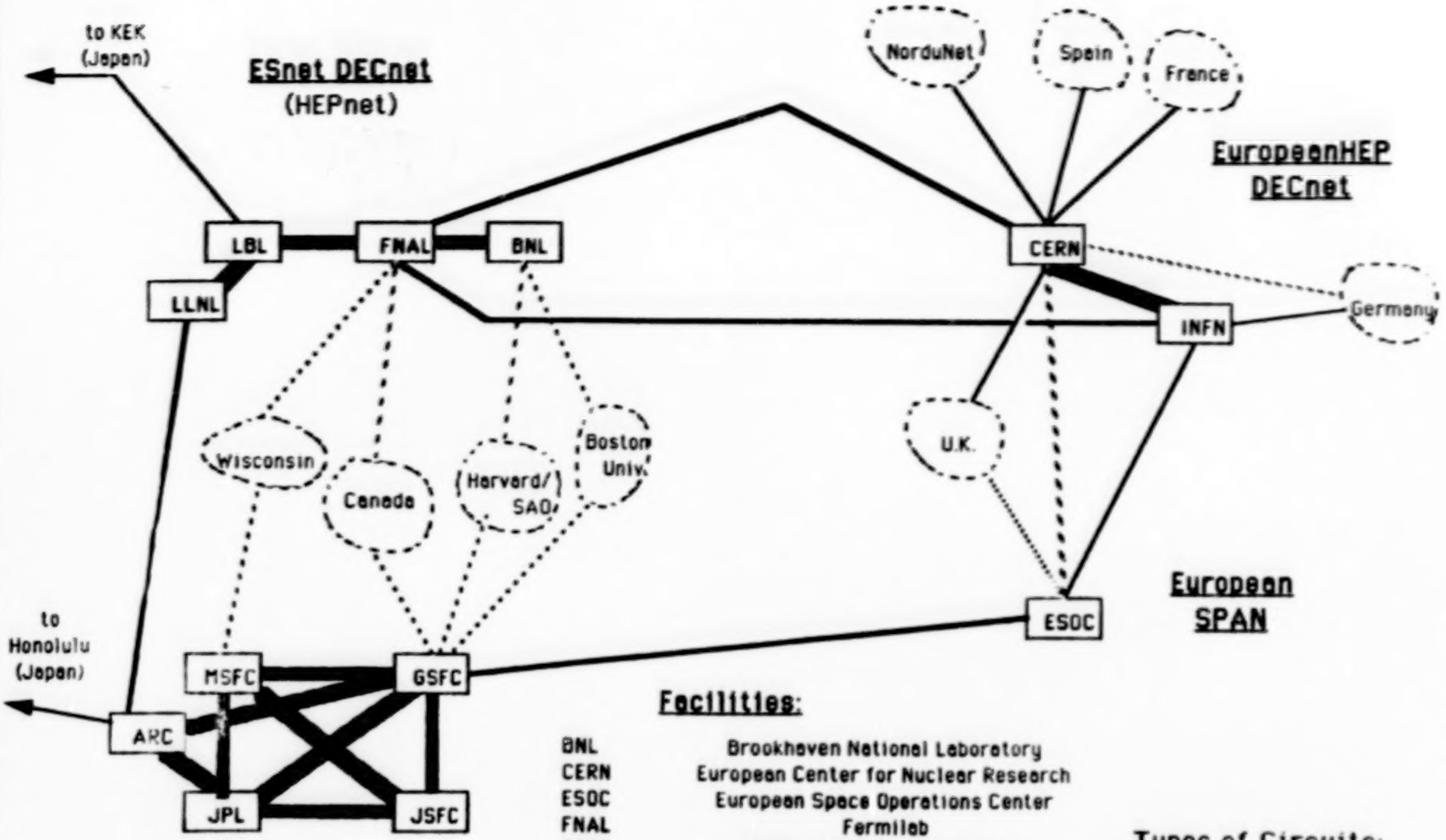
Interaction of Wide-Area DECnet Networks


to KEK
(Japan)
ESnet DECnet
(HEPnet)
NorduNet
Spain
France
EuropeanHEP
DECnet
LBL
FNAL
BNL
CERN
LLNL
INFN
Germany
Wisconsin
Canada
Harvard/
SAO
Boston
Univ.
U.K.
to
Honolulu
(Japan)
European
SPAN
ESOC
MSFC
GSFC
ARC
JPL
JSFC

Facilities:

BNL	Brookhaven National Laboratory
CERN	European Center for Nuclear Research
ESOC	European Space Operations Center
FNAL	Fermilab
GSFC	Goddard Space Flight Center
INFN	National Institute for Nuclear Research (Italy)
JPL	Jet Propulsion Laboratory
JSFC	Johnson Space Flight Center
LBL	Lawrence Berkeley Laboratory
SLAC	Stanford linear Accelerator Center
LLNL	Lawrence Livermore National Laboratory
ARC	Ames Research Center

NSI-DECnet
(formerly SPAN)

Types of Circuits:

▬	Network Backbone
—	Internetwork Link
• • •	Pending/Proposed Link
- - -	Facility Link

P. Demar
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11/90

FIGURE 3.

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WHY DO WE NEED TO UPGRADE TO PHASE V?

The driving force for an early transition to DECnet Phase V is the fact that the DECnet Internet has reached the practical addressing and routing limits of DECnet Phase IV. Also, DECnet Phase V promises integrated support for OSI, which is expected to be the protocol of choice for the future. Finally, the U.S. Government, through its Government OSI Profile (GOSIP) procurement policies will require its networked systems to support the OSI protocols.

PHASE IV ADDRESSING LIMITATIONS

DECnet Phase IV allows only 2 bytes for a node address, which is further divided into 63 areas. The DECnet Internet, which consists of numerous networks and hundreds of sites in many countries, cannot meet its addressing requirements with only 63 DECnet areas. For example, it is very difficult to inform sites in different countries, used to their own autonomy, that they need to share the same DECnet area and coordinate their address assignment policies. In addition, the cost of routing packets over the public switched facilities for European sites is staggering when sites share a single DECnet area and face charges for routine exchange of voluminous intra-area routing information.

Various area filtering techniques have been utilized to deal with the limited address space. These area filtering techniques have created "hidden" areas. Hidden areas are defined as those areas which are intentionally invisible to most of the network. As a consequence, certain area numbers can be duplicated without impact on normal network operations. These hidden areas, however, make network management difficult, and can break the network if the filtering mechanism is accidently removed.

DECnet OSI/Phase V provides 20 bytes of address space, obviously solving the limitations of Phase IV addressing. Just how big is 20 bytes? Well, it's probably enough to assign every toaster (5 billion per planet) on every planet in the universe (about 10E+22) with about 20 quadrillion addresses (a 2 followed by 16 zeros). Although not quite infinity, 20 bytes will probably cover addressing requirements until we retire.

PHASE IV ROUTING PROBLEMS

While Phase IV address space is bounded, Phase IV routing is boundless. This means the entire network is contained within a single routing domain, creating a number of problems:

- o The network is very vulnerable to inadvertent connections that bring duplicate area numbers into the network which, unlike hidden areas, are very visible. Visible duplicate area numbers cause network partitioning. In a partitioned network, parts of the network cannot exchange messages with other parts of the network.

- With a heavily interconnected topology using a single routing protocol, derivation of appropriate DECnet circuit costs for achieving proper traffic flow becomes very complex and very difficult.

- The numerous routing loops in the network often cause unexpected and inappropriate routing during periods of circuit instability. This causes poor performance, or in some cases, prevents packets from reaching their destination. Routing loops are a consequence of the failure of the Phase IV distance vector routing algorithm when used in a large network with a complex topology, like the DECnet Internet.

DECnet OSI/Phase V provides definable routing domain boundaries and the ability to control what routing information is propagated into or out of any particular network. With such control, inadvertent connections are harder to make, and ease problems of duplicated areas.

Also, the Phase V link state routing algorithm is much more robust and scalable than the Phase IV distance vector algorithm, and it eliminates the Phase IV routing loop problems.

THE TREND TOWARD OPEN NETWORKING PROTOCOLS AND U.S. GOSIP

It is generally accepted that most institutions will use OSI protocols eventually. The International Standards Organization (ISO) is driving the development of OSI protocols for the purpose of providing worldwide computer interoperability.

DECnet OSI/Phase V implements OSI protocols while preserving interoperability with DECnet Phase IV systems. No other protocol can provide for a relatively transparent transition from DECnet Phase IV to OSI (or other) protocols.

Also, the U.S. government mandates specification of OSI for networked systems in purchases. These practices are defined in the Government Open Systems Interconnect Profile (GOSIP) procurement specification (Federal Information Processing Standard 146). GOSIP also describes the OSI protocols to be used, and their formats. The intent is to eventually make all networked Government systems use OSI, resulting in greater interoperability and hence less reliance on any particular computer or network vendor. A significant portion of the network, therefore, will be required to support OSI.

CONSTRAINTS ON PHASE V TRANSITION PLANNING

There are several constraints affecting the development of the transition plan:

o Backwards compatibility with the existing Phase IV production network must be maintained throughout the transition.

The transition to Phase V will take an extended period of time, probably requiring several years. During the transition period, Phase IV systems throughout the network must maintain full connectivity with other Phase IV systems and also Phase V systems. In addition, the area filter mechanisms presently used in the Phase IV network must remain until they are either no longer necessary or they can be removed without disrupting the network.

o Technical constraints on the use of OSI addressing throughout the transition must be understood.

Because backwards compatibility with Phase IV systems must be maintained, networks are constrained to use Phase IV compatible addresses for Phase V systems during the transition period. Well, it's not surprising the number of Phase IV compatible addresses is identically equal to the number of Phase IV addresses - we still only get to use 2 bytes! The address management and assignment practices presently enforced in the Phase IV network will necessarily remain for assignment of Phase IV compatible addresses during the transition process. However, some systems will be identified as not requiring communication to Phase IV systems during the transition. These may implement their facility-assigned OSI addresses, but not a Phase IV compatible address. After the transition, sole use of the facility-assigned OSI address for all systems will be encouraged.

o Technical constraints on the use of OSI routing throughout the transition must be understood.

Phase V allows only one routing algorithm (Phase V or Phase IV) within a specific DECnet area. This means that "all" routers within an area must be able to support Phase V before that particular area can be upgraded. Host-based (VMS) routers present another problem. They will never be able to support the Phase V Level-2 (area) routing, and will probably be somewhat delayed in supporting Phase V Level-1 (intra-area) routing. Note that VMS routers used only for cluster aliasing are not affected. However, facilities using VMS routers for other than cluster aliasing are likely to be severely constrained in efforts to upgrade to Phase V. These sites will be encouraged to move from host-based routers to dedicated routers.

o The variety of hardware and software in use affects the timing of implementation.

Allowances for the variety of routers and systems in use in the DECnet Internet must be made in the transition plans. While some parts of the network contain only DEC hardware and software, other parts depend on third-party implementations of DECnet. The planning and timescale for the transition of the latter will almost certainly be different than the former.

- **The transition must be implemented in a manner consistent with the long term objective of being part of a global OSI network.**

  The new protocols implemented must conform to existing OSI recommendations and specifications. For government sites, GOSIP address formats as well as agency GOSIP transition plans need to be followed. The namespace will be structured to follow the OSI X.500 recommendations, and planned with the idea of becoming part of a global X.500 directory service when that becomes available.

  Routing under OSI must be planned and eventual implementation of "routing domains" consistent with local facility plans must be permitted.

- **The organizational complexity of the existing global internet must be considered.**

  The DECnet Internet crosses national boundaries as well as agency and facility jurisdictions. Therefore, the transition plan must be flexible enough to meet the differing needs and perspectives of individual facilities and agencies. A top-down approach using a "one strategy fits all" philosophy is very likely to fail miserably.

PHASE V TRANSITION GENERAL STRATEGY

Considering the goals and constraints of the transition, the general strategy for the transition of the DECnet Internet to OSI/Phase V will be based on the following:

- Network backbones are expected to be upgraded to Phase V at the earliest possible time. The underlying philosophy will be "backbone sites first, tail sites last". This provides two things: 1) a central framework around which to base the transition, and 2) upgrade of the major resources on the network at an early time in the transition (since they tend to be located at backbone sites).

- Detailed transition plans for individual networks will generally be based on an area-by-area upgrade - an incremental strategy. Phase IV areas within the DECnet Internet that are ready to upgrade will be identified. These areas will then coordinate a changeover to the use of Phase V protocols all at once. This is not quite as impossible as it sounds, because the primary issue in this changeover is upgrading the 'routing' nodes in an area. End systems may run either Phase IV or Phase V software in either a Phase IV or Phase V area. End systems can be upgraded gradually throughout the transition process.

  Two approaches are possible with an area-by-area transition. The first approach identifes the sites within an area ready to upgrade to Phase V. Sites sharing that area which are unprepared or unable to go to Phase V will be assigned new Phase IV addresses and moved, allowing the remaining the sites to proceed with Phase V implementation.

The second approach again starts with identifying sites within an area ready to upgrade to Phase V. This time, though, those sites ready to upgrade will first adopt new Phase IV addresses, thus decoupling them from sites not ready to upgrade. Then the sites with the new addresses will coordinate a changeover to Phase V routing protocols all at once. In some cases, the adoption of new Phase IV compatible address and the changeover to Phase V routing protocols will happen simultaneously.

It is likely that certain areas will remain permanent Phase IV areas to support those systems which will never run OSI protocols.

This incremental strategy provides a means of accelerating the transition process for those portions of the network ready to upgrade. It also provides justification (and motivation) for other sites to hasten their own OSI/Phase V implementations.

- Phase IV backwards compatibility will be preserved by adoption of a common high-order address, or "Phase IV prefix" for all the networks within the DECnet Internet. The common Phase IV prefix will be used to create a virtual routing domain for the Phase IV nodes within the network, preserving the Phase IV address structure. Phase V systems will be multihomed (have multiple addresses) when necessary. On a multihomed system, one address will be the Phase IV compatible address (common Phase IV prefix + existing Phase IV DECnet address). The other address will be the facility assigned OSI address. Addressing is further discussed in the next section.

- There will be a single namespace created to support the Phase V network. Namespace name and structure will be common, and implementation will adhere to guidelines. Directory replication and access, as well as clearinghouse location, will be tightly controlled down to the facility level. The namespace implementation will precede Phase V implementation, and sites will be allowed (encouraged) to utilize the namespace for existing Phase IV applications. Namespace issues are discussed in greater detail in the next section.

- Initially, the number of routing domains in the changing network will be minimized. As the transition progresses, implementation of routing domains will increase. However, there are technical reasons which prevent initial widespread use of routing domains. These reasons are presented in the next section.

- There will be a finite amount of time for completion of the transition across the entire network. After that time ends, the network will be declared a Phase V network, and use of extended address space will be encouraged. Phase IV areas (and Phase IV end systems within Phase V areas) may remain after this time, but direct access to wide-area network resources no longer will be guaranteed. "Poor man's routing" may be required to provide access for those systems.

- o ESnet-DECnet, NSI-DECnet, E-HEPnet, E-SPAN, and other network management teams controlling specific parts of the DECnet Internet will each refine its own transition plan, using the transition strategy it deems appropriate for its own network environment. The time scale for each of these individual transition plans will be independent of the others. However, transition strategies and implementation plans will be closely coordinated with other member networks.

TECHNICAL ISSUES FOR DECNET INTERNET TRANSITION PLANNING

The groundwork for understanding the existing network environment, the need for a transition, and the general strategy for the transition has been discussed. The following sections tackle addressing, naming, and routing issues in greater technical detail.

ADDRESSING

The OSI address format to be used by all U.S. Government Institutions is defined by GOSIP. The proper name for this address format is the "Network Service Access Point", or NSAP. The NSAP is 20 bytes long and is shown in Figure 4.

```
<---IDP---> <-------------------------DSP--------------------------------->
            <-------------HO-DSP--------> <-LA-> <-----ID-----> <-SEL->
_______________________________________________________________________________
| AFI | IDI | DFI |      AA      | RESV | SNID | AREA | END SYSTEM | NSEL |
-------------------------------------------------------------------------------
   1     2     1         3          2      2      2        6           1   bytes

  47   0005   80     qqqqqq    0000    nnnn   mmmm  abcdefghijkl   yy
                     003400 (NASA)
                     000400 (DOE)
```

IDP : Initial Domain Part
DSP : Domain Specific Part
HO-DSP : High Order Domain Specific Part
LA : Local Area
ID : end system IDentification
SEL : transport SELector byte

AFI : Authority and Format Identifier
IDI : Initial Domain Identifier
DFI : Data Format Identifier
AA : Administration Authority
SNID : Sub-Network ID

FIGURE 4. - THE GOSIP NSAP

GOSIP defines values for the IDP and the DFI. NASA and DOE have applied to the National Institute of Standards and Technology for the value of the "AA" field, and it has been assigned: NASA will use "003400" and DOE will use "000400", as shown in Figure 4. The remainder of the address will be assigned according to internal NASA and DOE recommendations.

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AN ADDRESSING PROBLEM

An address field of great interest is defined by the combination of the IDP and HO-DSP fields, or the "high-order address". To explain this, a small digression is needed.

> PHASE V TRANSITION RULE: Phase IV systems can communicate only with systems having the same high-order address as the Phase V routers to which they are connected.

That is, the portion of the address to the left of the Local Area (LA) field must be identical on all Phase V systems if Phase IV end systems are to communicate during the transition. The reason for this is simple: Phase IV systems have no knowledge or ability to generate any address but a Phase IV style address containing an area between 1 and 63 and a node address between 1 and 1023. However, in a Phase V network, Phase IV end-systems actually are assigned a high-order address: it is the high-order address of the Phase V router to which the Phase IV system is connected. But because a Phase IV system itself has no knowledge of its high-order address, it can't generate a different one. Therefore, a Phase IV system can talk only to those systems that are connected to a router with the same high-order address as the Phase V router that is connected to the Phase IV system.

Therefore, the statement of the problem is:

> If all institutions adopt the OSI address format with arbitrary high-order addresses, how can Phase IV system connectivity be maintained?

THE ANSWER

OSI specifies support for multiple addresses for a single system. A system with multiple addresses is said to be "multihomed". If one of the addresses on a Phase V multihomed system contains a prefix common to all other Phase V nodes, then Phase IV connectivity can be preserved. The form of this address is described in Figure 5.

```
<-IDP-> <--------HO-DSP----------------> <----------THE REST-------->
 _________________________________________________________________
| zz  |           PPPP                  | AREA | END SYSTEM | NSEL |
-------------------------------------------------------------------
<----------Phase IV prefix------------>    2        6          1
```

FIGURE 5. - PHASE V/PHASE IV COMPATIBLE ADDRESS FORMAT

This common address can be up to 20 bytes long, and conforms to OSI Standards. (Note that the "AREA:END SYSTEM" must translate to a Phase IV compatible address, i.e. area between 1 and 63, node address between 1 and 1023.)

Therefore, one address on Phase V systems can be GOSIP (or ANSI or other standard). The other address will be the address linking the Phase IV DECnet Internet. For example, a node using Phase IV compatible address 7.39 can have two completely independent addresses as follows:

1. GOSIP COMPLIANT ADDRESS:

IDP	HO-DSP	LA	ID	SEL
47 0005	80 003400 0000 1100	2366	08002b123456	yy

2. PHASE IV/V COMPATIBILITY ADDRESS:

<---------Phase IV Prefix------>

IDP	HO-DSP	LA	ID	SEL
99	4242	0007	aa000400271C	xx

(The "99 4242" is a hypothetical example of a unique Phase IV prefix used in the DECnet Internet for the purpose of transition.)

Therefore, multihomed Phase V systems satisfy requirements for use of OSI while preserving Phase IV compatibility during the transition period.

ADDRESSING AUTHORITY

For the purpose of implementing a Phase IV to OSI/Phase V transition, the existing methods for obtaining "Phase IV" addresses will be unchanged throughout the Phase V transition period. Phase IV addresses will be used with the unique Phase IV prefix to ensure Phase IV/V transparency during the transition. As described above, however, the Phase IV address is unrelated to the value of the facility-assigned OSI address. Sites can receive OSI addresses from their OSI Address Authority at any time (of course).

NAMING ISSUES

The directory and naming service that will be used during the transition is DEC's "Digital Naming Service", or DECdns. DECdns provides, among other things, address-to-name and name-to-address translation services as well as user application and other general naming services. DECdns provides a robust method to keep names and addresses up to date, and a method for replicating portions of the namespace for redundancy. DECdns is expected to interoperate with the OSI X.500 directory service when that becomes available. Network support for DECdns during the transition to DECnet OSI/Phase V is a requirement.

The following definitions are important to understanding naming issues.

Logical namespace - the global structure defining how systems are named.

Physical namespace - the implementation in a working network of the Logical Namespace.

Logical namespace issues are separate from physical namespace issues, and are treated separately.

LOGICAL NAMESPACE ISSUES

The Logical namespace to be used for the DECnet Internet will adhere to OSI X.500 recommendations as closely as possible. It will also be kept as shallow as possible. The general structure of an X.500 name is:

.COUNTRY.ORG.OS...

where ORG is the organization "owning" this specific portion of the namespace, and OS is an "organizational specific" identifier assigned by the owning organization.

NASA's current recommendation for the naming of NASA field centers is the following:

.US.NASA.center.name
e.g.
.US.NASA.MSFC.SSL

DOE's recommendation, and the one now being used in the OSI transition guidelines for that agency is the following:

```
.US.facility.name           or          .US.DOE.facility.name
  e.g.              (for small DOE sites)          e.g.
.US.FNAL.FNMFE                              .US.DOE.CHI.name
```

We can draw three observations from these recommendations:

1) This is backwards to the TCP/IP Internet standard - we don't love it, but if the names are to adhere to X.500 recommendations it is unavoidable that DECnet Phase V system names will be reversed with respect to TCP/IP Internet names.

2) There is no upper-level domain as in the Internet standard, i.e. no "EDU" or "COM" field. The feeling is these fields do not convey useful meaning, and are contrary to the X.500 recommendations.

3) DEC recommends against putting the country symbol in the DECdns namespace for a network. This is because most sites will be joining a larger network - and hence namespace - in the future, where the upper level directories are already provided. This is not suitable for the already international DECnet Internet, where the country code must be present to distinguish international organizations.

DOE and NASA are not naming authorities for X.500 (nobody is, yet!). However, they will recognize and register Internet Facility level domain names, such as "FNAL", "UCSD", and "MSFC" in the namespace for sites currently served by the DECnet Internet.

The intent is to join the DECnet Internet namespace with the global X.500 directory services when available. This will be done by removing the appropriate top level directories in the DECdns namespace and pointing the remainder at the X.500 root. At that time, one presumes, a global naming authority and registration board will exist, and facilities will register with that organization.

PHYSICAL NAMESPACE ISSUES

Institutions such as major DOE sites and NASA field centers will emplace name servers. An invitation to join the logical namespace structure provided by these name servers will be extended to associates. DEC (and we) recommend that there be at least two name servers per local area network.

Each facility joining the namespace will be responsible for maintaining the master copy of its own top level (facility) directory at its local site, just as is presently the case for Internet (TCP/IP) domain name servers. However, read-only copies of facility level directories will likely be located elsewhere in the network as well.

More work needs to be done in deciding guidelines for replication and access of the physical namespace across the DECnet Internet. (Replication assures reachability in case of a network link or server failure.)

ROUTING ISSUES

INTER-DOMAIN VS. INTRA-DOMAIN ROUTING

There is a lot of confusion about inter-domain and intra-domain routing. Many confuse dynamic and static routing issues, and others believe routing hierarchy is many levels deep (it's only two), and routing domains depend on specific fields of the NSAP (they don't). So, sit back, clear your mind, and let's start from scratch.

INTRA-DOMAIN ROUTING

DECnet OSI/Phase V uses a protocol named "IS-IS Routing Exchange Protocol" for intra-domain routing. (IS = Intermediate System, i.e. a router). This protocol is currently at draft international standard stage and will be a full OSI protocol probably within a few months. The IS-IS protocol uses a more robust and scalable routing algorithm than Phase IV called "Link-State Routing". However, the following analogy with DECnet Phase IV will be used to illustrate an important concept.

Like DECnet Phase IV, IS-IS routing has two "and only two" routing levels: Level 1 and Level 2. There is no deeper hierarchical routing specified by this standard. An IS-IS Level 1 router keeps information on every end system in its area, like Phase IV DECnet. An IS-IS Level 2 router keeps information on every other area in the network, again, like Phase IV.

Okay, so what is an OSI area? This is where the NSAP plays a role. The IS-IS standard routes area (Level-2) traffic based on the value of the IDP + HO-DSP + LA fields. Therefore, these fields define the OSI area, as shown in Figure 6.

```
 _____________________________________________________________________________
|  IDP  |                               DSP                                   |
|_______|_____________________________________________________________________|
        |      HO-DSP       |      LA       |          ID           |  SEL    |
        |___________________|_______________|_______________________|_________|

<----------LEVEL 2 ROUTING------------>
                                         <--LEVEL 1 ROUTING-->
```

Figure 6. - IS-IS ROUTING AND THE NSAP

Now, the amount of space allowed for areas is huge - up to 13 bytes! Instead of being constrained by only 63 areas, an OSI network could wallow in 2.0E31 areas. One can immediately see both the advantages and problems associated with the possibility of tremendous numbers of OSI areas.

INTER-DOMAIN ROUTING

To prevent problems associated with zillions of areas (and for other reasons), network management can define "Routing Domains."

> ROUTING DOMAIN: A routing domain is a collection of systems that are told they are running the same routing protocol.

A routing domain can be defined which allows all systems within it to keep their routing information confined, or better - everybody else's routing information out. Defining a routing domain can isolate a group of areas from exchanging routing information with the rest of the world while allowing well-defined interconnection points so that communications between routing domains is still possible. Defining a routing domain, then, can solve two problems. One, it can reduce the number of areas in a network, and two, it can protect a network from routing problems in a neighboring network.

It's important to realize that the mechanism used to define a routing domain is not particularly related to any specific field in the NSAP prefix (the portion of the address above the LA field, Figure 4). There is no special field in the NSAP such that when bits in it are changed, the routing domain is changed as well. A routing domain boundary can be set between any two sites whose NSAP prefixes are different. Conversely, a routing domain can contain multiple NSAP prefixes.

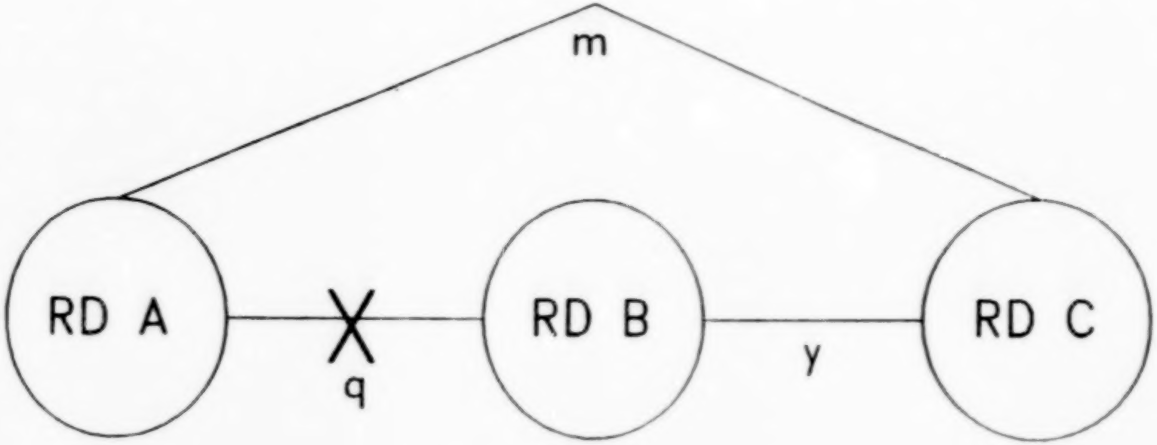
DRAWBACKS TO ROUTING DOMAINS

There are some drawbacks to setting up routing domains, especially when Phase IV to Phase V transition strategies are considered.

First, there is no OSI standard for dynamic inter-domain routing. This protocol is under development and it will take many months, if not longer, before it will be available. For the present, then, all inter-domain routing is static, and must be manually configured and manually fixed if a line goes down. This means network managers (or their operators) are responsible for adding and deleting addresses from the address tables and fixing circuit problems - manually. The more connections a routing domain has, the more manually intensive maintenance and operations become. Compare this with DECnet Phase IV routing where the network automatically attempts to repair a circuit outage by using a fallback path if available, regardless of the complicated physical topology - even in the middle of the night!

A classic example of the headaches introduced by manual maintenance is shown in Figure 7, "The two-hop problem". In this simplified drawing, Routing Domains A, B, and C are connected in a line. Routing Domain A and C normally communicate through B using circuits q and y. Circuit m exists between A and C as a backup. Now, assume circuit q fails. Routing domain A recognizes q has failed, and begins to re-route its traffic destined for B and C over circuit m. So far, so good. To simplify this a little, let's look in particular at messages from A to C. A packet from A arrives in C over circuit m. C receives the packet and sends it to its destination in C. In response, the destination system tries to reply to the source system in A by sending a packet back into the network. However, because circuit q is not in C's routing domain, C has no knowledge of its failure. Therefore, C dutifully sends the reply packet to A *through circuit y*. B gets the packet and says "nope, I can't forward this, because circuit q is down" and sends it back to C. C gets the packet back, and again tries to send it to A *over circuit y*. C is really stupid about all this, but that's what static links can do to a network. C will never automatically re-route the packet over m, because C is never told that circuit q is

"The Two-Hop Problem"



- Normal static paths are RD B and C reachable through link "q" and link "y"."
- Link "m" designed as backup connection for A to C communication.
- Link "q" fails. *No* auto failover to backup link "m"
- Manual intervention required to re-route packets from C-A and B-A through C.

Figure 7.

down and thus should readjust its own routing to compensate. The packet will bounce around between C and B until it reaches its maximum cost or visits, and then it disappears: this is the "black-hole" effect of static routing. To use circuit m, a network manager in C will have to manually adjust the circuit parameters.

Second, network management cannot set a routing domain between two sites which use the same Phase IV area and must maintain Phase IV connectivity. This constraint is certainly the most restrictive for planning routing domain boundaries during the transition.

CONSIDERATIONS FOR THE DECNET INTERNET

Politics implies lots of routing domains. It is naive to assume that individual facilities, when having the ability to shield their networks, will not take the opportunity to do so. In the long run, setting routing domain boundaries will provide a mechanism for protecting a network's routing functions from problems in a neighboring routing domain. This means routing domains undoubtedly will be implemented down to site level, eventually.

However, prudence, responsive network routing, and preservation of Phase IV connectivity and network manager sanity indicate the network should support very few routing domains, at least at the start of the transition. It has been proposed that a logical place to set a routing domain boundary at the start of the transition would be across the Atlantic, between U.S. and European sites.

So, it is clear that we must eventually allow for the existence of many routing domains, but it is also clear that we will divide the DECnet Internet into only a few, and possibly just two, routing domains at the start of the transition. Therefore, the global transition strategy must incorporate mechanisms for identifying logical placement of new routing domain boundaries and coordinating the setting of these boundaries throughout the transition process.

SUMMARY

The need for a Phase V/OSI transition is clear. The limits of DECnet Phase IV protocools have been reached, and the Government is requiring implementation of OSI protocols for its agencies and departments.

The major issues for moving the Phase IV network to OSI/Phase V are being tackled for the DECnet Internet by the HSDCG. The implementation of addressing and naming are largely understood and accepted. A choice for the global "Phase IV prefix" still has to be made. The emplacement of physical name servers and the operation of the namespace in the Phase IV network is progressing.

More work remains to be done in planning for the use of routing domains in the DECnet Internet during the transition.

The general strategy to move the DECnet Internet Phase IV network to a Phase V network is to use an area-by-area transition plan, starting with network backbones, while preserving Phase IV connectivity throughout transition.

Detailed transition plans are being developed by the individual network participants taking into account the issues being coordinated by the HSDCG.

References:

1. Digital Equipment Corporation, DECnet/OSI Phase V, making the transition from Phase IV, Order no EK-DNAPV-GD, 1989.

2. ISO/TC 97 Information processing systems - Data Communications - Network service definition Addendum 2: Network layer addressing, ISO 8348 Addendum 2, 1988.

3. R. Kevin Oberman, EDWG DNANS Naming Policy and Guidelines, Version 1.2, May 1990, Lawrence Livermore National Laboratory

4. D. Oran, Intermediate system to intermediate system intra-domain routeing exchange protocol for use in conjunction with the protocol for providing the connectionless-mode network service (ISO 8473), DP 10589, 1990.

5. U.S. Government Open Systems Interconnection Profile (GOSIP), Draft, Version 2.0, FIPS 146, April 1989

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F. Security Subgroup Presentations

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NSI

NASA Science Internet

NSIUWG
SECURITY SUB-GROUP

SECURITY SUB-GROUP

Security - How and Why

GAO audit and report critical of NASA network management

NASA image is Vulnerable - Any breach becomes a "NASA Problem"

Security of the network requires adequate end-node security

NSI cannot require compliance, but all policies and procedures will be consistent with NASA policy. No "extraordinary" measures will be required - however, common sense will.

NSI will provide the user community with assistance and tools to allow non-interference management of tail sites.

NSI SECURITY

TOOLKITS

- Enable remote sites to self-evaluate their vulnerabilities
- Working w/NIST to model threats and identify existing tools
- Evaluating LLNL "SPI" and CMU "COPS" packages
- Priority being given to developing a set of UNIX tools
- Will update and revise the VMS (SPAN) toolkit
- Goal is VMS/UNIX equivalent tools
- NSI-Approved and NSI-Developed

SECURITY SUB-GROUP

SECURITY POLICIES AND DOCUMENTATION

Goal: To establish a network-wide "Security Baseline"

All policy will be NHB 2410.9-compliant

Will address UNIX & VMS, DECnet & TCP/IP (OSI as appropriate)

Will reflect required Risk Analysis elements

Will include Audit Trail guidance based on inputs from FBI and Justice Depts

Currently in draft form - Expected to publish in FY90

SECURITY SUB-GROUP

RISK ANALYSIS & MANAGEMENT

Government sites required to perform their own. NSI will provide guidance.

NSI will do a "Network" Risk Analysis.

NSI is working with Code NTD to develop a uniform NASA approach consistent with AIS guidelines.

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G. User Services and Applications Presentations

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Requirements Management: A CSR's Perspective

Presentation to the NSIUWG User Services Subgroup

Joanie Thompson

Sterling Software, Inc.

NSI
NASA Science Internet

Requirements Management: A CSR's Perspective

The goal of my presentation is to give the NSI User Services Subgroup an understanding of the Requirements Management process by describing the tools which the Customer Service Staff uses to manage the networking requirements.

First off, take a quick look at the chart on the next page. Go ahead, then come back to this page. I'll wait...

The process is about as simple as it looks. :-) But have no fear, your Customer Service Representative (CSR) understands the chart and knows how to navigate your networking requirements into and out-of all those boxes, diamonds and rectangles.

To give you a better understanding of the process (sans chart), I have designed this presentation to be more of an "narration with pictures". There is a cover page which describes the tool and how it is employed by the CSR -- that is the "narration". The "picture" is the sample chart/letter/form which follows the narration page.

Ready? Here we go....

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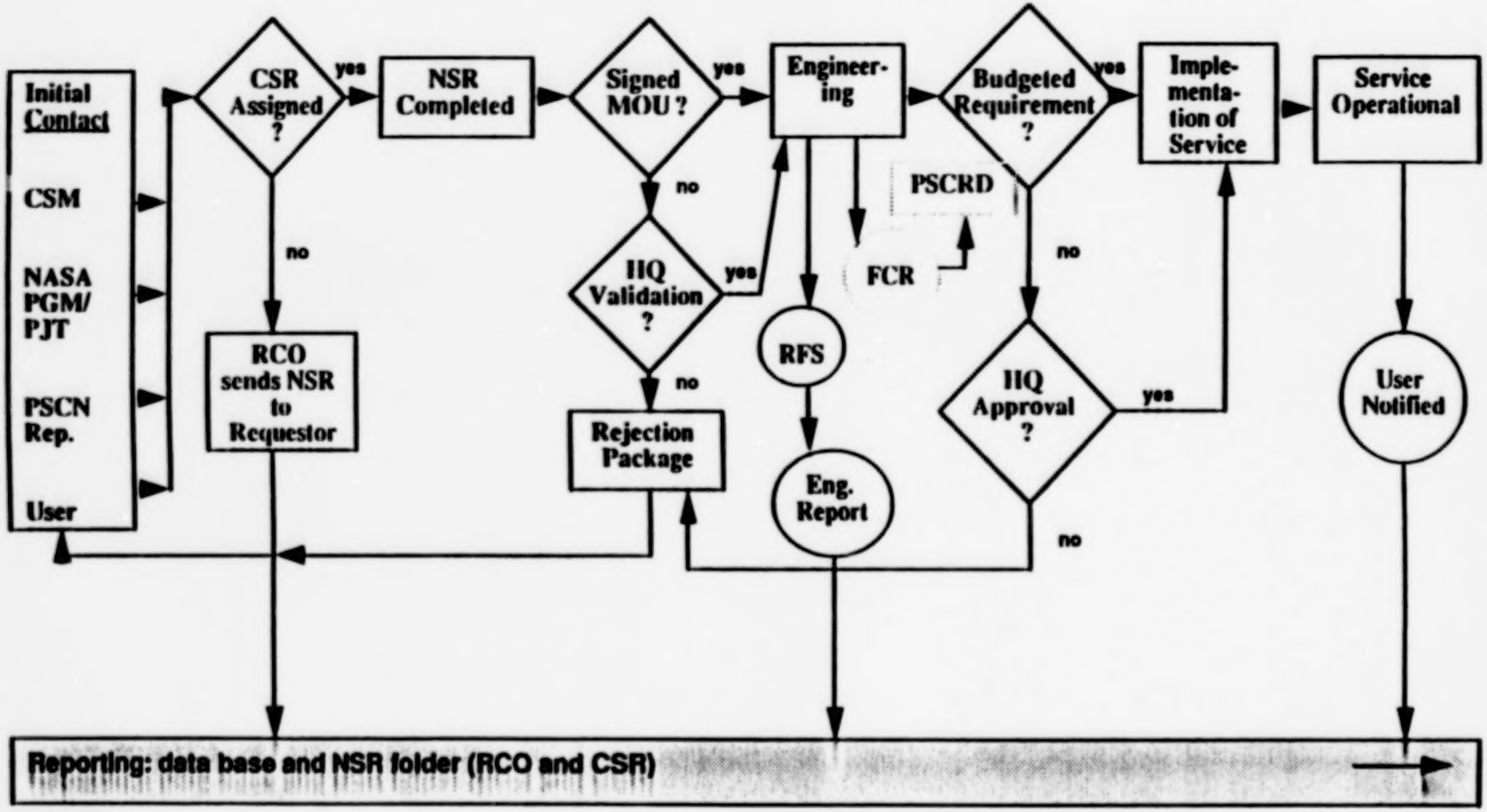
PAGE

Customer Service Overview of Network Service Request Processing



Initial Contact

CSM

NASA PGM/ PJT

PSCN Rep.

User

CSR Assigned ?

yes

no

RCO sends NSR to Requestor

NSR Completed

Signed MOU ?

yes

no

HQ Validation ?

yes

no

Rejection Package

Engineering

RFS

Eng. Report

FCR

PSCRD

Budgeted Requirement ?

yes

no

HQ Approval ?

yes

no

Implementation of Service

Service Operational

User Notified

Reporting: data base and NSR folder (RCO and CSR)

5/15/90

Discipline Customer Service Representative Responsibility Matrix

Get to know your CSR! If you or your project need a new network connection, an upgrade to your existing services or other network services the best place to start is with the CSR.

Customer Service Representative Responsibility Matrix

CODE	DISCIPLINE	CSR	PHONE NUMBER AND EMAIL ACCESS
SZ	Astrophysics	Joanie Thompson	J. Thompson, (415) 604-4550 joanie@nsipo.nasa.gov AMES::"joanie@nsipo.nasa.gov"
SC	Communications	Maria Gallagher	M. Gallagher, (415) 962-7753 maria@nsipo.nasa.gov AMES::"maria@nsipo.nasa.gov"
SE	Earth Science and Applications	Kathy Bosovich Lenore Jackson	K. Bosovich, (415) 604-5859 bosco@nsipo.nasa.gov AMES::"bosco@nsipo.nasa.gov" L. Jackson, (301) 286-7251 NSSDCA::JACKSON jackson@nssdca.gsfc.nasa.gov
SM	Flight Systems Division	TBD Christine Falsetti	C. Falsetti, (415) 604-6935 falsetti@nsipo.nasa.gov AMES::"falsetti@nsipo.nasa.gov"
SB	Life Sciences	Kathy Bosovich Lenore Jackson	K. Bosovich, (415) 604-5859 bosco@nsipo.nasa.gov AMES::"bosco@nsipo.nasa.gov" L. Jackson, (301) 286-7251 NSSDCA::JACKSON jackson@nssdca.nasa.gov
SN	Microgravity Science and Applications	TBD Christine Falsetti	C. Falsetti, (415) 604-6935 falsetti@nsipo.nasa.gov AMES::"falsetti@nsipo.nasa.gov"
SL	Solar System Exploration	Joanie Thompson	J. Thompson, (415) 604-4550 joanie@nsipo.nasa.gov AMES::"joanie@nsipo.nasa.gov"
SS	Space Physics	Maria Gallagher	M. Gallagher, (415) 962-7753 maria@nsipo.nasa.gov AMES::"maria@nsipo.nasa.gov"

updated 3/20/91

NSI
NASA Science Internet

Extract from a Sample Memorandum of Understanding

If the customer represents the interests of a science program or project, they are encouraged to work with the Customer Service Manager, Christine Falsetti, to establish a Memorandum of Understanding (MOU). The MOU is a contract between NSI and an OSSA Science Project requesting network services. For many projects, this has proven the best way to uniformly state networking requirements. The MOU is a valuable reference tool for the CSR as it states the roles and responsiblities of each party.

MEMORANDUM OF UNDERSTANDING

between

PROJECT X

and the

NASA SCIENCE INTERNET

for

PROJECT X SCIENCE NETWORK COMMUNICATIONS

September 31, 1990

Approvals:

name, Project Scientist,
PROJECT X

Christine M. Falsetti, Customer Service Manager
NASA Science Internet

name, Project Manager,
PROJECT X

Frederic N. Rounds, Project Manager

name, Program Scientist,
PROJECT X

Anthony Villasenor, Program Manager
NASA Science Internet

name, Program Manager,
PROJECT X

Joseph Bredekamp, Chief
Information Systems Branch

name, Director,
Astrophysics Division

Ray J. Arnold, Director
Communications and Information
Systems Division

I. PROLOGUE

NASA Flight Projects as well as Discipline Data Centers have requirements to communicate with their investigators and system users. Many of these communications require electronic connections for digital data access and transport, for access to shared computational resources and software, and for electronic mail. The distributed nature of the investigators and users who have a wide variety of computer/software systems requires national as well as international connectivity operating in a heterogeneous environment.

The NASA Science Internet Project (NSI) has been charged with integrating and implementing the Flight Project and Discipline Data Center network communications requirements within the NASA Office of Space Science and Applications (Code S) into a cost effective, efficient and reliable national communications network with international connectivity. A variety of computer systems and networking protocols are supported. The NSI-DECnet and the NSI-TCP/IP are both managed by the NSI in achieving its mission. The NSI works closely with the Code T Program Support Communications Program in providing these services.

PROJECT X : *this will be a brief description of what the project is about, its functions, goals or objectives.*

NASA OSSA Communications and Information Systems Division (Code SC) has programmatic responsibility and NASA Ames Research Center has project management responsibility for the NASA Science Internet. The NASA OSSA Astrophysics (Code SZ) has programmatic responsibility and *appropriate NASA center* has project management responsibility for PROJECT X. PROJECT X has both domestic and international science communications requirements that require the services of NSI.

This Memorandum of Understanding (MOU) defines the PROJECT X Program science communications requirements on the NASA Science Internet and describes the roles and responsibilities of these two organizations in support of these requirements.

II. INTRODUCTION

A. PURPOSE

This MOU documents the science computer networking requirements of PROJECT X and the corresponding services and equipment to be provided by the NASA Science Internet in support of these requirements. The MOU describes the roles and responsibilities of PROJECT X and NSI in the definition of requirements, design, procurement, implementation, use, operations, monitoring, maintaining, testing and evaluation of the NSI-provided networking services. This document sets the general agreements, constraints and interfaces between the two organizations.

Network Service Request Form

The Customer Service Reps use the NSR to gather and document networking requirements. The information captured on the NSR must be complete and accurate as it is submitted to our Work Control Desk for entry into NSI's master Requirements Database.

NASA SCIENCE INTERNET **NETWORK SERVICE REQUEST**	NSI NSR # Date Prepared
RETURN TO: NASA SCIENCE INTERNET PROJECT OFFICE Mail Stop 233-8 NASA Ames Research Center Moffett Field, CA 94035-1000 Commercial: (415) 604-5859 FTS: 464-5859 FAX: (415) 604-6999 FTS: 464-6999	**FROM** Designated Requirements Initiator: Name (Please Print) NASA Org Code CSR Assigned: ________ Principal Investigator: ________ Institution: ________

Description of Services Requested:

Requested Start Date: ________ **Estimated Stop Date:** ________

From End User:	**To Computing Resource (or another End User):**
Last Name First Name Initial	Last Name First Name Initial
Organization	(Organization)
Facility	(Facility)
(Suborganization)	(Suborganization)
Address	(Address)
Address	(Address)
City State Zip	(City) (State) (Zip)
Commercial Phone (FTS Phone)	(Commercial Phone) (FTS Phone)
(E-Mail Address (if any))	(E-Mail Address (if any))
(Host/Terminal Type (Mfg. - Model)) (Operating System)	(Host/Terminal Type (Mfg. - Model)) (Operating System)
(Existing External Network Addresses (if any))	(Existing External Network Addresses (if any))
(LAN Connection (if any))	(LAN Connection (if any))

Description of Service Requested: ________

1 of 2

NSI Form 1 (May '90)

NASA SCIENCE INTERNET
NETWORK SERVICE REQUEST

NSI NSR #

From End-Point Site:	To End-Point Site:
Organization	[Organization]
Facility	[Facility]
Suborganization	[Suborganization]
Building	[Building]
Floor	[Floor]
Room	[Room]
Point of Contact/NSI Site Coordinator	[Point of Contact/NSI Site Coordinator]
Email	Email
Commercial Phone FTS Phone	[Commercial Phone] [FTS Phone]

Specific NASA Program/Project Reference:

Headquarters Code ____________________

UPN No.: ____________________

Program/Project Name: ____________________

NASA Contract/Grant Number: ____________________

[Expiration Date:] ____________________

[Contracting Officer's Technical Representative]

[Commercial Phone:] ____________________

[FTS Phone:] ____________________

Description of Service (Cont'd):

2 of 2

NSI Form 1 (May '90)

Instructions For Completing the Network Service Request

When a customer chooses to complete the NSR, we provide an NSR Packet which includes the Form Instructions, a blank form and samples of completed forms.

Notice that the page layout of the NSR Form Instructions closely resembles the actual NSR form. This was not an accident. Keeping the customer in mind, it was seen as one of the best ways to guide the person through the form. Of course, your CSR is always available to answer questions or help complete the form.

NSR Form Instructions

The NSR form is two sided. Side one has information your Customer Service Representative will need in order to submit your request for connectivity to NSI engineering. Side two has space for more detailed information regarding the nature of service you are requesting.

Each field that appears on the NSR form is described in the subsequent table.

Accompanying these instructions are samples of completed NSR forms. These examples are meant to serve as guidelines and are based on how a request *might* look when generated. Use the example that best fits your particular situation.

Finally, if you still have difficulty, feel free to contact an NSI Customer Service Representative.

Thanks so much for your cooperation. We look forward to working with you.

NSI Customer Service Staff

Field Reference: Side One of the NSR Form

NSI NSR#	This is for internal NSI use. Do not fill it out.
Date Prepared	The date you complete the form.

Description of Services Requested:

Requested Start Date:	When you want the service to start.
Requested Stop Date	When you want the service to stop, or the end of your scientific mission.

From End User: This is the individual requesting the connectivity

Last Name, First Name, Initial	Your last, first name and initial. Please include any titles and/or degrees you wish to be associated with.
Organization:	Name of the parent body with which you are affiliated.
Facility	Your site's physical location.
Suborganization	Your division within your organization (sometimes this is the project name.)
Address	Your site's full address including suite or room number.
E-Mail Address	Your electonic mail address.
Host/Terminal Type Operating System	Type of computer you are currently using as the primary network resource.
Existing External Network Addresses	The numeric IP address or DecNet address.
LAN connection	Is there a Local Area Network at your site? Are you connected to it?

To Computing Resource (or another end user): Here is where you tell us what you need on the *other end* of the connection. A *resource* can be a network, a computer, or a person.

Last Name, First Name, Initial	The full name of the computing resource, type of resource needed, or individual with which you need connectivity.
Organization	Parent organization with which you want connectivity.
Facility	Physical location of the site where you want connectivity.
Suborganization	Name of the suborganization with which you want connectivity.
Address	The full address of the remote resource (including suite or room number).
E-Mail Address	Remote end user's electonic mail address.
Host/Terminal Type Operating System	Name of the remote host computer where you need connectivity.
Existing External Network Addresses	The numeric IP address or DecNet address of the remote computer.
LAN Connection	Is there a Local Area Network at the remote site?

Description of Service Requested:
Your description should include the following:

1. Briefly describe the nature of your scientific research and your project/program's current/future needs for network services.
2. Type of service desired (what do you want the connection to accomplish for you? What will you expect to use the network for? To transfer research data? To send electronic mail? What else?
3. What type of scientific data will be transmitted? How large are the files?
4. How often (x per day) do you expect to use the network for the aforementioned purposes?

Field Reference: Side 2 of the NSR form

This side describes the technical information that the NSI staff needs from you in order to work with **remote locations and personnel** in establishing your connectivity.
End point to end point are the actual **physical** locations where the circuit will originate and terminate. NSI works closely with remote site technical personnel during all phases of establishing, and later, maintaining your network service.

From End-Point Site	Where your physical connection will originate
Organization/Facility/Suborganization	Same as side one
Floor/Room	The physical location of your host (server or networking resource)
Point of Contact (NSI Site Coordinator)	Your site's technical contact for NSI
Email	His/her email address
Commercial /FTS	His/her current phone number/s

To End-Point Site	Where your physical connection will terminate
Organization/Facility/Suborganization	Same as side one, but describing the remote site
Floor/Room	The physical location of the remote site host (server or networking) resource
Point of Contact (NSI Site Coordinator)	The remote site's technical contact for NSI
Email	His/her email address
Commercial /FTS	His/her current phone number

Specific NASA Program/Project Reference: NASA/OSSA (Office of Space Science & Applications) has standard prerequisites for validating your request for connectivity. This part of the form ensures that you are eligible for connectivity under NASA/OSSA regulations.

Note: In order to receive service from NSI, you must establish that you are part of a valid NASA/OSSA (Office of Space Science Applications) funded program or project All requests for connectivity go to NASA headquarters for validation. If you are not sure about the validity of your project status, please contact your site COTR (Contracting Officers Technical Representative) for more information. If you are unsure of how to contact your COTR, please contact an NSI CSR .

Headquarters Code	The OSSA code with which you are affiliated
UPN Number	The NASA code identifier
Program/Project Name	The name of the NASA project with which you are affiliated
NASA Contract/Grant Number	The numerical contract or grant number that proves you are funded by NASA. Please make sure that you include the expiration date.
Contracting Officer's Technical Representative	The NASA official at your site who oversees and directs funding for your NASA contract or grant. This is the person to contact regarding questions you may have about validation.
Commercial Phone /FTS Phone	The COTR's current phone number
Description of Service (Con't'd)	More space to finish your description from side one

NASA SCIENCE INTERNET
NETWORK SERVICE REQUEST

NSI NSR #

Date Prepared 6/4/90

RETURN TO:
NASA SCIENCE INTERNET PROJECT OFFICE
Mail Stop 233-8
NASA Ames Research Center
Moffett Field, CA 94035-1000
Commercial: (415) 604-5859 FTS: 464-5859
FAX: (415) 604-6999 FTS: 464-6999

FROM Designated Requirements Initiator:
Jim weiss (Name (Please Print)) SZ (NASA Org Code)
CSR Assigned: Joanie Thompson
Principal Investigator: Bill Hopkins
Institution: GSFC

Description of Services Requested:

Requested Start Date: 7/1/91
Estimated Stop Date: End of mission

From End User:	**To [✓ Computing Resource] (or another End User):**
Ali, Muhammud (Last Name, First Name, Initial)	(Last Name, First Name, Initial)
Univ of Hardknocks (Organization)	NASA (Organization)
(Facility)	GSFC (Facility)
Dept. of Astronomy (Suborganization)	IUE RDAF (Suborganization)
6233 Leftjab Drive (Address)	Code 684.1 (Address)
(Address)	(Address)
Sockem (City) S.C. (State) 61661 (Zip)	Greenbelt (City) MD (State) 20771 (Zip)
801/693-7275 (Commercial Phone) (FTS Phone)	(Commercial Phone) 888-8800 (FTS Phone)
none (E-Mail Address (if any))	N/A (E-Mail Address (if any))
SUN 3/60: SUNOS, uVAX: VMS (Host/Terminal Type (Mfg. - Model)) (Operating System)	VAX8800 (Host/Terminal Type (Mfg. - Model)) VMS (Operating System)
none (Existing External Network Addresses (if any))	IUE.GSFC.NASA.GOV, IUE:: (Existing External Network Addresses (if any))
yes, thinwire Ethernet (LAN Connection (if any))	yes, (LAN Connection (if any))

Description of Service Requested:

Requirement is for access to the ultraviolet spectroscopy data available from the IUE RDAF at GSFC. Access to ADS hosts required as well. Primary use of line will be for file transfer (35Mbytes/week), remote logon and Email to colleagues at GSFC, Univ Colorado at Boulder. There are no special security considerations. Hosts at Hardknocks are on LAN.
NOTE: uVAX is running Wollongong TCP/IP product.

1 of 2

NSI Form 1 (May 90)

NASA SCIENCE INTERNET
NETWORK SERVICE REQUEST

NSI NSR #

	From End-Point Site:	To End-Point Site:
Organization	Univ of Hardknocks	NASA
Facility	Central Communications	GSFC
Suborganization		Code 684.9
Building	202	21
Floor	basement	basement
Room	14	6
Point of Contact/NSI Site Coordinator	Caroline Caruso	Randy Thompson
Email	none	RTHOMPSON@IUE.GSFC.NASA.GOV
Commercial Phone	801/693-6207	
FTS Phone		888-8800
	FAX: 801/693-6208	FAX: 301/286-7642

Specific NASA Program/Project Reference:

Headquarters Code SZ

UPN No.: 399

Program/Project Name: IUE (International Ultraviolet Explorer)

NASA Contract/Grant Number: NAG62947

[Expiration Date:] 10/93

[Contracting Officer's Technical Representative] Dr. Don West

[Commercial Phone:] 301/286-6901

[FTS Phone:] 888-6901

Description of Service (Cont'd):

2 of 2

NSI Form 1 (May 90)

NASA SCIENCE INTERNET
NETWORK SERVICE REQUEST

NSI NSR #

Date Prepared 1/30/90

RETURN TO:
NASA SCIENCE INTERNET PROJECT OFFICE
Mail Stop 233-8
NASA Ames Research Center
Moffett Field, CA 94035-1000
Commercial: (415) 604-5859 FTS: 464-5859
FAX: (415) 604-6999 FTS: 464-6999

FROM Designated Requirements Initiator:
Dr Frank Six — S
Name (Please Print) — NASA Org Code

CSR Assigned: Joanie Thompson

Principal Investigator: Prof. Bob Eli

Institution: Univ of West Virginia

Description of Services Requested:

Requested Start Date: 3/30/90

Estimated Stop Date:

From End User:

Eli, Prof Bob
Last Name — First Name — Initial

Univ of West Virginia
Organization

Dept of Civil Eng.
Facility

(Suborganization)

Address

Address

Morgantown VA 26506
City — State — Zip

304/293-3550
Commercial Phone — (FTS Phone)

bob@wvnvm.bitnet
(E-Mail Address (if any))

VAX 11/785, SGI — VMS, Unix
(Host/Terminal Type (Mfg - Model)) — (Operating System)

(Existing External Network Addresses (if any))

LAN connection planned
(LAN Connection (if any))

To Computing Resource (or another End User):

general Internet connectivity
Last Name — First Name — Initial

(Organization)

(Facility)

(Suborganization)

(Address)

(Address)

(City) — (State) — (Zip)

(Commercial Phone) — (FTS Phone)

(E-Mail Address (if any))

(Host/Terminal Type (Mfg - Model)) — (Operating System)

(Existing External Network Addresses (if any))

(LAN Connection (if any))

Description of Service Requested:

Prof. Eli requires general internet connectivity for file transfer --particularly from NASA centers, NSF Supercomputer centers, DOE centers (LANL, Argonne Labs) to Univ. Twenty 25Mbyte files will be transferred daily.

Email to the above sites plus the other JOVE investigators required.

Prof Eli is modeling weather patterns on the supercomputers and post processing on the SGI.

1 of 2

NASA SCIENCE INTERNET
NETWORK SERVICE REQUEST

NSI NSR #

From End-Point Site:

Univ West Virginia
Organization

Comm. Center
Facility

Suborganization

21
Building

1
Floor

3
Room

Bill Bowers
Point of Contact/NSI Site Coordinator

bowers@uvm.bitnet
Email

304/293-7176
Commercial Phone
FTS Phone

To End-Point Site:

NASA
[Organization]

GSFC
[Facility]

[Suborganization]

1
[Building]

basement
[Floor]

53
[Room]

Jeff Burgan
[Point of Contact/NSI Site Coordinator]

JEFF@NSIPO.NASA.GOV
Email

464-5705
[Commercial Phone] [FTS Phone]

Specific NASA Program/Project Reference:

Headquarters Code S

UPN No.: 998

Program/Project Name: JOVE

NASA Contract/Grant Number: NA72391

[Expiration Date:] 10/92

[Contracting Officer's Technical Representative]

Bev Robbins

[Commercial Phone:]

[FTS Phone:] 824-1763

Description of Service (Cont'd):

Current BITNET connection does not satisfy connectivity requirements.

Research is not mission critical; some downtime of network acceptable

2 of 2

NSI Form 1 (May 90)

Sample Notification of Receipt

Completed NSR in hand, the customer's request for networking services is often acknowledged in a letter such as this. But sometimes, the CSR breaks down and employs the "other" technology (ie telephone). On to the validation step!

NASA Science Internet Project Office
NASA/Ames Research Center
M/S 233-8
Moffett Field, CA 94035-1000

December 21, 1990

Dr. James G. Mantovani
Florida Institute of Technology
Dept. of Physics & Space Sciences
150 W. University Blvd.
Melbourne, FL 32901-6988

Dear Dr. Mantovani,

I have received your request for a "SPAN" network connection to support your JOVE-sponsored research. It has been documented as NSR 21338 and you can get status by contacting me.

As your request is explicitly for a "SPAN" connection, I thought that the following explanation would be helpful:

The NASA Science Internet Project is currently consolidating the "SPAN" and "NASA Science Network" circuits into a network called the NASA Science Internet (NSI). Architecturally speaking "SPAN" is being redesigned, but the DECNET functionality will still exist. This is because the NASA Science Internet supports both DECNET and TCP/IP networking services over the same circuits.

I am delighted to tell you that there already exists an NSI Interoperability Gateway which supports file transfer, remote logins from your Internet-resident VAXes to VAXes on the NSI "DECNET" and electronic mail. As it is possible that the Interoperability Gateway might satisfy your "DECNET" networking needs I am enclosing the documentation and ask that you try it out.

However, I will still want to discuss networking issues with you over the phone. You can expect to hear from me in early January 1991 when I return from vacation.

Sincerely,

Joanie Thompson
415/604-4550
joanie@nsipo.nasa.gov

cc: CFalsetti
NSR21338

Sample Validation Packages

Since every request for network connectivity must be validated, the CSRs have developed a standard "Validation Package" for submission to the appropriate Validation Contact at NASA Headquarters. The "Package" consists of a cover letter and Validation Sheet which is signed and returned to our office. The Customer Service support staff maintains a log to track the progress of the "Package" while at Hq.

National Aeronautics and Space
Administration

Ames Research Center
Moffett Field, California 94035-1000

Reply to Attn of: ED:233-8

October 29, 1990

Mr. Greg Hunolt
National Aeronautics and Space Administration
Code SE
Washington, D.C. 20546-0001

Dear Mr. Hunolt:

Please review the attached Code SE Validation Sheets for NASA Science Internet service. If we are to implement this service, we require your validation before proceeding. If you are unable to validate this request, please provide a brief explanation on the Validation Sheet. In either case, your signature is required.

The Customer Service Representative for Code SE network service requests is Kathy Bosovich. She will be happy to provide you with any additional information or status on any Code SE network request. Kathy can be reached at FTS 464-5859, (415) 604-5859 or by NASAMAIL: kjbosovich.

Return signed validation sheets to your Customer Service Representative, Kathy Bosovich at:

NASA Ames Research Center
NASA Science Internet Office
ms: 233-8
Moffett Field, CA 94035-1000

FAX (415)604-6999, FTS 464-6999.

Thank you for your assistance.

Deborah D. Puku

for Christine M. Falsetti
Customer Service Manager
NASA Science Internet Office

cc: DPuku
FRounds
KBosovich
MGoodman

NASA HQ VALIDATION SHEET
from the
NASA Science Internet Office
October 29, 1990

The following narrative describes a request for networking services. We ask that you review it and indicate whether the requirement is valid or not valid. If not valid, please provide a brief explanation. If you require more information about this request, contact the Customer Service Representative (CSR) for Code SE.

Mr. Michael Goodman at Marshall Space Flight Center has requested general Internet connectivity for the following locations in support of the WETnet Project. WETnet needs capability to transfer files from mainframe to mainframe McIDAS without using McIDAS communication protocols, and interactive file transfer between mainframe McIDAS and PC-McIDAS.

Listed below are the location that are requested for WETnet connectivity:

Eric Barrett, Remote Sensing Unit, University of Bristol, England NSR 21122
Francis Bretherton, Space Science & Engrng Ctr, Univ of WI, NSR 21123
Robert Brown, Dept of Atmospheric Sciences, Univ of WA, NSR 21124
Robert Chase, CO Ctr for Astrodynamics Res Univ of CO, NSR 21127
William Emery, CO Ctr for Astrodynamic Res, Univ of CO, NSR 21131
Robert Crane, Dept of Geography, Pennsylvania State Univ, NSR 21129
Jerry Felde, Geophysics Laboratory (AFSC), Hanscom AFB, NSR 21132
Catherine Gautier, Univ of CA-San Diego, Scripps Institution, NSR 21133
Barry Rock, Univ of New Hampshire, NSR 21137
William Olson, Univ of Wisconsin-Madison, NSR 21136
John Janowiak, NOAA/NWS/NMC-Climate Analysis Ctr, W.D.C., NSR 21134
Rod Scofield, NOAA/NESDIS, Camp Springs, MD, NSR 21139

Please indicate if this request is: (check one)

___✓___ a valid requirement for Code SE.

_______ not a valid requirement for Code SE. (Please provide brief explanation below.)

comments:

Signed: Greg Hunolt ____ Date: Nov. 6, 1990
Greg Hunolt, NASA HQ: Code SE

Please return to:

Kathy Bosovich
NASA Ames Research Center
NSIO
ms: 233-8
Moffett Field, CA 94035-1000

National Aeronautics and Space
Administration

Ames Research Center
Moffett Field, California 94035-1000

Reply to Attn of: ED:233-8

February 14, 1991

Dr. James Willett
Code SS
National Aeronautics and Space Administration
Washington, D.C. 20546-3191

Dear Dr. Willett:

Please review the attached Code SS Validation Sheets for NASA Science Internet service. If we are to implement this service, we require your validation before proceeding. If you are unable to validate this request, please provide a brief explanation on the Validation Sheet. In either case, your signature is required.

The Customer Service Representative for Code SS network service requests is Maria Gallagher. She will be happy to provide you with any additional information or status on any Code SS network request. Maria can be reached at FTS 464-3601, (415) 604-3601 or by NASAMAIL: mlgallagher.

Return signed validation sheets to your Customer Service Representative, Maria Gallagher at:

mail stop 233-8
NASA Ames Research Center
NASA Science Internet Office
Moffett Field, CA 94035-1000

FAX (415)604-0063, FTS 464-0063.

Thank you for your assistance.

Christine M. Falsetti
Customer Service Manager
NASA Science Internet Office

cc: MGallagher
DPuka
FRounds

NASA HQ VALIDATION SHEET
from the
NASA Science Internet Office
February 14, 1991

The following narrative describes a request for networking services. We ask that you review it and indicate whether the requirement is valid or not valid. If not valid, please provide a brief explanation. If you require more information about this request, contact the Customer Service Representative (CSR) for Code SS, Maria Gallagher.

> Gordon Lentz of the University of Chicago has requested an upgrade in the existing 9.6 DECnet circuit from the University of Chicago to MSFC, in anticipation of a substantial increase in use of the network to support various experiments on both the CRRES and Ulysses spacecraft. (NSR #21299)
>
> The PI at the University of Chicago is Dr. J. Simpson who is working with various Co-Investigators in both the U.S. (primarily at JPL and AFGL) and Europe. (NSR #21300)
>
> The connectivity will be used for quick-look data access from the ionboard experiments on both crafts, as well as increased data exchange and transfer among the experimentors.

Please indicate if this request is: (check one)

X a valid requirement for Code SS.

not a valid requirement for Code SS. (Please provide brief explanation below.)

comments:

Signed: James W Willett Date: 3-1-91
Dr. James Willett, NASA HQ: Code SS

note: For tracking purposes, NSI has assigned these requests as #21299 and #21300. Your Customer Service Representative can provide more information and/or status on these NSRs.

Please return to:

Maria Gallagher
ms: 233-8
NASA Science Internet Office
NASA Ames Research Center
Moffett Field, CA 94035-1000
(415) 604-3601

Headquarters Validation Contacts

The following chart shows who the CSR applies to for Validation of requirements. Validation is a necessary and crucial step in the NSR Process since NSI Engineering is unable to perform cost analyses, design network solutions or order circuits without it.

CHRISTINE FALSETTI
CUSTOMER SERVICE MANAGER

CODE	DISCIPLINE	CUSTOMER SERVICE REPRESENTATIVE	HQ OFFICIAL VALIDATOR	DESIGNATED VALIDATOR
S	Office of Space Science and Applications	Joanie Thompson-JOVE	Dr. Joseph Alexander (Code S) Robert C. Rhome (Code R)	
SZ	Astrophysics	Joanie Thompson	Dr. Frank Giovane	Dr. Guenter Riegler
SC	Communications	Maria Gallagher	Dr. Anthony Villasenor	
SE	Earth Science and Applications	Kathy Bosovich and Lenore Jackson	(Dr.) Greg Hunolt	
SM	Flight Systems Division	TBD/Christine Falsetti	Dr. Phillip J. Cressy Jr.	
SB	Life Sciences	Kathy Bosovich	Dr. Richard (Dick) Keefe	D. Duncan Atchison (Lockheed)
SN	Microgravity Science and Applications	TBD/Christine Falsetti	(Dr.) Mary Kicza	
SL	Solar System Exploration	Joanie Thompson	Dr. Guenter Strobel	
SS	Space Physics	Maria Gallagher	Dr. James Willett	(Dr.) Eldon Whipple

Sample Rejection Letter

Not very often, the Headquarters Validation Contact flags a requirement as invalid and the CSR drafts a letter like the following.

July 31, 1990

Mr. Alan Strong
Project Coordinator, CEORS
Department of the Navy
United States Military Academy
Annapolis, MD 21402

Dear Mr. Strong,

We regret to inform you that your request for connectivity to the NASA Science Internet has been denied.

All of our requirements must go through the NASA headquarters validation process in order to be approved for funding. When your request was submitted to NASA headquarters for validation, neither Dr. George Ludwig (Earth Sciences Discipline validator) nor Dr. Marion Lewis were able to associate your request with a valid NASA OSSA program or project.

Currently, we consider this request closed. Further supporting documentation providing evidence of a NASA/OSSA grant or contract for your site is needed if you wish to pursue this matter further. If you have any questions, please feel free to contact me at the number below. Thank you for your patience in this matter.

Sincerely,
Lenore Jackson

NSI Customer Service Representative
Code SE
(301) 286-7251
NSSDCA::JACKSON
jackson@nssdca.gsfc.nasa.gov

Interface with Engineering

Once validated, the CSR introduces the requirement to the NSI Engineering staff. The Engineering Manager assigns one of his staff to seek costing estimates and perform design analyses and makes recommendations on implementation. The Engineering Manager makes the final decision on implementation.

The CSR staff maintains records and tracks the progress of requirements through this phase of the process too.

WHAT: Agenda for the Requirements Engineering Meeting

WHEN: Thurs, March 7, 1991 2:30-3:30

WHERE: Room 247

WHO: Engineering staff and Customer Service Reps

NEW REQUIREMENTS

NSR 21299 Request for upgrade to existing NSI-DECnet services between Univ of Chicago and MSFC, GSFC
PROJECT: CRRES
CSR: Maria

NSR 21300 Request for upgrade to existing NSI-DECnet services between Univ of Chicago and JPL
PROJECT: Ulysses
CSR: Maria

NSR 21366 Reqmt for Email, remote logon, file transfer between University of Puerto Rico and MSFC
PROJECT: JOVE
CSR: Joanie

ACTIVE REQUIREMENTS open for discussion

NSR 21027 Request to upgrade existing 9.6 NSI-DECnet to 56Kbps dual-protocol between GSFC and Yale University.
PROJECT: Code SZ Astrophysical Theory Program
CSR: Joanie
History

02/28/91: Eng requested copies of the users proposal to NSI.
03/07/91:

NSR 21345 Onizuka AFB, Sunnyvale, CA to ARC
NSI/DECnet services requested to support researcher.
PROJECT: CRRES
CSR: Maria
History

01/31/91: Milo M. recommends NSI use PacBell for this reqmt. Concurrence by Bill J. SR to B.Yeager required. NSI to provide DSU & maint.
02/21/91: Mark to prepare and submit SR.
02/28/91: Thom delegated job of preparing SR. ARC POC is Jeff Burgan.
03/07/91:

NSR 21352 Internet connectivity from Crystal City, DC to NASA HQ
PROJECT: Scientific and Technical Info Division Code NT
CSR: Kathy
History

01/31/91: Eng will talk to Jeff concerning this issue. Ckt provider

Customer Notification of Completion/Confirmation

In reality, the CSR is alerted by the NSI Network Manager when the service is in place and operational. A phone call to the customer is usually made before the Notification of Completion/Confirmation is produced.

From this point forward, the CSRs' role is largely complete. But there are two other NSI groups who are providing services to the network user; NSI Operations Center (NOC) and NSI User Support Office.

With the help of sophisticated Network Monitoring techniques, The NOC Staff are able to act upon network problems well before the users notice and report the problem. Network monitoring is ongoing 24 hours a day, 7 days a week.

The NSI User Support Office staffs a user help desk which is the first stop for all user questions/problems. The help desk is available 12 hours a day, 5 days a week with off-shift support from the NOC. The office also maintains an on-line Network Information Center (NIC) which is available through the network.

NASA Science Internet Project Office
NASA/Ames Research Center
M/S 233-8
Moffett Field, CA 94035-1000

May 16, 1990

Dr. Joseph Veverka
Cornell University
Center for Radiophysics & Space Research
422 Space Sciences Bldg.
Ithaca, NY 14853

Dear Dr. Veverka,

Your request for an upgrade to the existing network service between Cornell University and JPL to facilitate your work as a member of Galileo's Solid-State Imaging team has been implemented and is now fully operational.

NSI Engineering has worked with Mr. Joel Plutchak for your site to verify that the circuit is performing reliably. NSI Operations will monitor the circuit 7 days a week, 24 hours a day. Should you experience problems with this new service, your first course of action should be to contact your local networking expert who would then contact NSI Operations staff should it be necessary.

Sincerely,

Joanie Thompson
NSI Customer Services
415/604-4550

cc: Ted Clarke/JPL
Mark Leon/ARC
Christine Falsetti/ARC

An Article Reprint: Requirements Management

What the CSRs would like their customers to understand is that the CSR is the focal point for getting the requirements into and through the NSR Process. There are a number of internal and external groups which the CSR interfaces with to complete a service request. The following article indicates the groups while describing the process.

Requirements Management in the NASA Science Internet

by Deborah D. Puku

In October 1990, the NASA Science Internet (NSI) Project established the Customer Service group to manage collection of OSSA program and project science data communications requirements. Currently, the Customer Service responsibilities include communications requirements management, program and project interface, publication distribution, and other value-added services for NSI.

The Customer Service group is managed by Christine Falsetti at NASA Ames Research Center, who reports directly to Fred Rounds, the NSI Project Manager. Currently, group members are located at Ames Research Center and Goddard Space Flight Center. Customer Service representatives (CSRs) are assigned the requirements management responsibilities by OSSA discipline, as follows:

CODE	DISCIPLINE	CUSTOMER SERVICE REPRESENTATIVE
SZ	Astrophysics	Joanie Thompson
SC	Communications	Maria Gallagher
SE	Earth Science and Applications	Kathy Bosovich and Lenore Jackson
SM	Flight Systems Division	TBD/Christine Falsetti
SB	Life Sciences	Kathy Bosovich and Lenore Jackson
SN	Microgravity Science and Applications	TBD/Christine Falsetti
SL	Solar System Exploration	Joanie Thompson
SS	Space Physics	Maria Gallagher

PHONE NUMBER AND EMAIL ACCESS

K. Bosovich, (415) 604-5859
bosco@nsipo.nasa.gov

M. Gallagher, (415) 604-6362
maria@nsipo.nasa.gov

C. Falsetti, (415) 604-6935
falsetti@nsipo.nasa.gov

L. Jackson, (301) 286-7251
jackson@nssdca.gsfc.nasa.gov

J. Thompson, (415) 604-4550
joanie@nsipo.nasa.gov

For NSI service, program and project managers are encouraged to work with the NSI Customer Service Manager to establish a Memorandum of Understanding. (Individual requestors seeking NSI services should contact their discipline CSR: see chart.) A Memorandum of Understanding (MOU) is a contract between NSI and the program or project requesting network services. It describes the roles and responsibilities of each party, and details the requirements for wide area network connections. An MOU also offers several advantages: program requirements are uniformly documented, MOU customers are given project priority, requirements are documented in the NSI budget cycles, and the requests for service are potentially expedited through the validation process.

As an MOU is being negotiated, a CSR is assigned and a Science Networking Representative (SNR) from the OSSA program or project is identified. Requests for network connections are documented on a Network Service Request (NSR) form by the Science Networking Representative with the help of the Customer Service Representative. The requirements are tracked through the NSR process as outlined in brief here:

I. Requirements Gathering--

Information needed includes site addresses, host/terminal type, any existing network connection information, and a comprehensive description of service requested. Also necessary are names of the associated OSSA program or project, NASA Headquarters code, grant numbers, and names needed for Headquarter validation and approval.

II. Headquarters Validation--

Note: This step can be waived with an approved MOU. When the NSR is complete, a description of service is forwarded to the designated validator of the appropriate discipline at NASA Headquarters (i.e., Life Sciences, Astrophysics, etc.). The discipline involved then reviews the request and decides whether the service is necessary and relevant in support of the identified OSSA program/project. This process can take anywhere from a week to months, depending on the schedules of OSSA discipline representatives.

III. Engineering Review--

Once the NSR is validated, NSI Engineering performs design analyses. Decisions are based on a number of factors including existing network connections or proximity, and use of shared bandwidth. The goal is to maximize bandwidth efficiency while delivering the desired level of performance to the user.

IV. Administration Review--

The Engineering plans, when complete, are then given to Administration for a budget review. If the request is submitted early enough, cost can be forecasted into NSI's budget for the appropriate fiscal year. Many NSRs are entered years in advance to ensure they will be funded by NSI.

V. Implementation--

The NSI Site Installation and Engineering Teams work with the Program Support Communications Network and other circuit providers to implement design plans and ensure that the connection is functional and running.

VI. Operations--

All network connections are monitored 24 hours a day, seven days a week. NSI Operations has a hotline number for immediate service, (415) 604-3655. They monitor the wide area network, diagnose and verify problems, coordinate resolutions, and track and document findings.

Through all phases of the NSR process, the user has one designated CSR. The CSR will keep the users updated and notified on any status changes.

An important complimentary function to the requirements management process is NSI support of major OSSA conferences by providing network connections to attendees. This allows members of the science community access their home institutions for electronic mail, remote login, and file transfers. It also allows attendees to meet their CSRs, pick up documentation, and discuss the requirements process.

If you would like to benefit from any of the services provided by the NSI Customer Service group, please contact your appropriate Customer Service Representative listed in the chart above.

Reprinted from the Office of Space Science and Applications Information Systems Quarterly *October 1990 Issue No. 1. Updated for the NSI Users Working Group Proceedings, February 1991.*

NASA Science Internet (NSI)

Overview of the NSI User Support Office

NSI USO

Lenore A. Jackson
Advanced Data Flow Technology Office
STX/Code 930.4
Goddard Space Flight Center

Presentation to
NASA Science Internet User Working Group

February 12, 1991

ADFTO

Overview of the NSI/USO

- Hot Line for User Questions
- NSI Database Updates
- Documentation
- Toolkit Distribution and other On-Line Services

ADFTO

Overview of the NSI/USO

- Hotline for NSI Questions
  - Phone calls, Electronic Mail Messages, FAX, and Walk-ins
  - Automated log of user Network Problems/Resolutions
  - NSI Network Information
    - E-Mail between networks (e.g., DECnet, BITNET, TCP, DECnet
    - Information clearinghouse for several NSI/DECnet database
    - Site contact information
    - Node contact information

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Overview of the NSI/USO

- **Available Documentation**
  - NSI Cookbook (formerly SPAN Cookbook)
  - Management of NSI/DECnet (formerly SPAN)
  - Security Policies and Procedures
  - The Yellow Pages
  - Using - East - Gateway- E-Mail Syntax
  - Various NSI Publications

Overview of the NSI/USO

- On-Line Services via NSI NIC
  - Documentation
    - Cookbook
    - E-Mail Syntax
    - DECnet Database Distribution
    - NPSS Access Via Marshall Network Control
    - Pass-Thru Account

Overview of the NSI/USO

- NSI Database Update and Distribution (DECnet/TCP)
  - Establish a working relationship with routing center liasons
  - Receive node additions and deletions from approved sources (DECnet)
  - Update internal files for office purposes
  - Run Genlist.com produces area US files
  - Run build.com produces-US DECnet database
    - Checks for duplicate nodenumber and/or nodename
    - Automatically deletes all extraneous information
  - Correct any discrepancy and re-run build com
  - The new DECnet SPAN - DB. is automatically moved to the DECnet Default directory where it is accessable to all DECnet Routing Center liasons and tail sites.

ADFTO

WHO YOU GONNA CALL?

NASA Science Internet User Support Office
(NSI USO) Code 930.4
Advanced Data Flow Technology Office
Goddard Space Flight Center
Greenbelt, MD 20771

301-286-7251 FTS 888-7251
(alt. 301-286-9514/FTS 888-9514)
(FAX 301-286-5152)

DFTNIC::NSIHELP (6148::NSIHELP)
nsihelp@dftnic.gsfc.nasa.gov (nsihelp@128.183.10.3)
(C:USA,A:TELEMAIL,P:INTERNET,ID:"<nsihelp(a)dftnic.gsfc.nasa.gov>")
NSIHELP@DFTBIT

DL 2/8/91

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The NSINIC On-Line System

Brian Lev
Advanced Data Flow Technology Office
STX/Code 930.4
Goddard Space Flight Center

Presentation to the
NASA Science Internet User Working Group
February 12, 1991

ADFTO

The NSINIC On-Line System

I. **Background**

- A. **A Little NSI History**
- B. **The ADFTO's Other On-Line Servers**

II. **NSINIC On-Line**

- A. **The Current System**
- B. **How It Works**
- C **NSINIC: The Next Generation**

III. **Summary**

DL 2/8/91

ADFTO

The NSINIC On-Line System

General Background:

NASA became involved with dedicated wide-area networking with the establishment of the DECnet-based Space Physics Analysis Network (SPAN) in 1981 and the TCP/IP-based NASA Science Network (NSN) in 1987.

After a series of NASA Network Management Retreats in late 1990, SPAN and the NSN were joined into a unified NASA Science Internet (NSI).

With establishment of the unified NSI, the Goddard Space Flight Center was tasked with setting up a Network Information Center (NIC), which was to include an on-line user help system.

The NIC staff made the decision to temporarily host the NSINIC system on already existing on-line systems in use for SPAN and the GSFC LAN.

DL 2/8/91

The NSINIC On-Line System

Network Servers Provided by Goddard's ADFTO

A. **Services Hosted on DFTNIC.gsfc.nasa.gov (VAX 8250)**

1. **NSI Network Information Center On-Line System (NSINIC)** -- new service.

2. **Network Information On-Line Aid System (NICOLAS)** -- approx. 102 user logins/day, current total over 77000. Listed in the Internet Resources Guide by invitation.

3. **Anonymous FTP File Server** -- Approximately 1.5 MB disk space allocated to 236 VMS and Macintosh files; currently averages over 9 accesses per day.

B. **Services Hosted on DFTSRV.gsfc.nasa.gov (Sun 3/260)**

1. **USENET News Server** -- Over 140 MB disk space allocated to more than 800 newsgroups, supporting 76 client systems; sample monitoring has shown up to 25 simultaneous users

2. **Anonymous FTP File Server** -- 48 MB allocated to over 200 UNIX, VMS and Macintosh files; averages over 20 accesses per day.

C. **Services Hosted on DFTSUN4.gsfc.nasa.gov (Sun 4/260)**

1. **White Pages Server** -- Entire GSFC telephone book available, as well as listings for all other White Pages project participants (over 100 sites); accessible with login "fred".

D **Services Hosted on NSSDCA.gsfc.nasa.gov (VAX 8650)**

1. **SPAN Network Information Center On-Line System (SPAN_NIC)** -- First of NASA's major on-line network servers; includes NSI-DECnet (formerly SPAN) node database queries, "how to" files, and network documentation. Will be folded into next release of NSINIC system.

DL 2/8/91

ADFTO

The NSINIC On-Line System

Other On-Line Services Provided by the ADFTO

A. **Services Hosted on DFTNIC (VAX 8250)**

1. **BITNET Access Server** -- Encapsulates BITNET (RSCS) packets in DECnet; currently supporting ROSAT and Crustal Dynamics projects at Goddard.
2. **X.25 Access Server** -- Encapsulates X.25-related packets in DECnet; currently supporting ROSAT and several Code 500 projects at Goddard.
3. **DNS/DFS Server** -- Supporting approx. 25 nodes in the CAC and CSDR clusters at Goddard.

B. **Services Hosted on DFTSRV (Sun 3/260)**

1. **TCP/IP Domain Name Server** -- Recorded over 12 accesses/minute during work hours.

ADFTO

The NSINIC On-Line System

The Current System:

Hosted on the DFTNIC VAX 8250, which is part of both NSI-DECnet and NSI-TCP/IP, with additional links to BITNET.

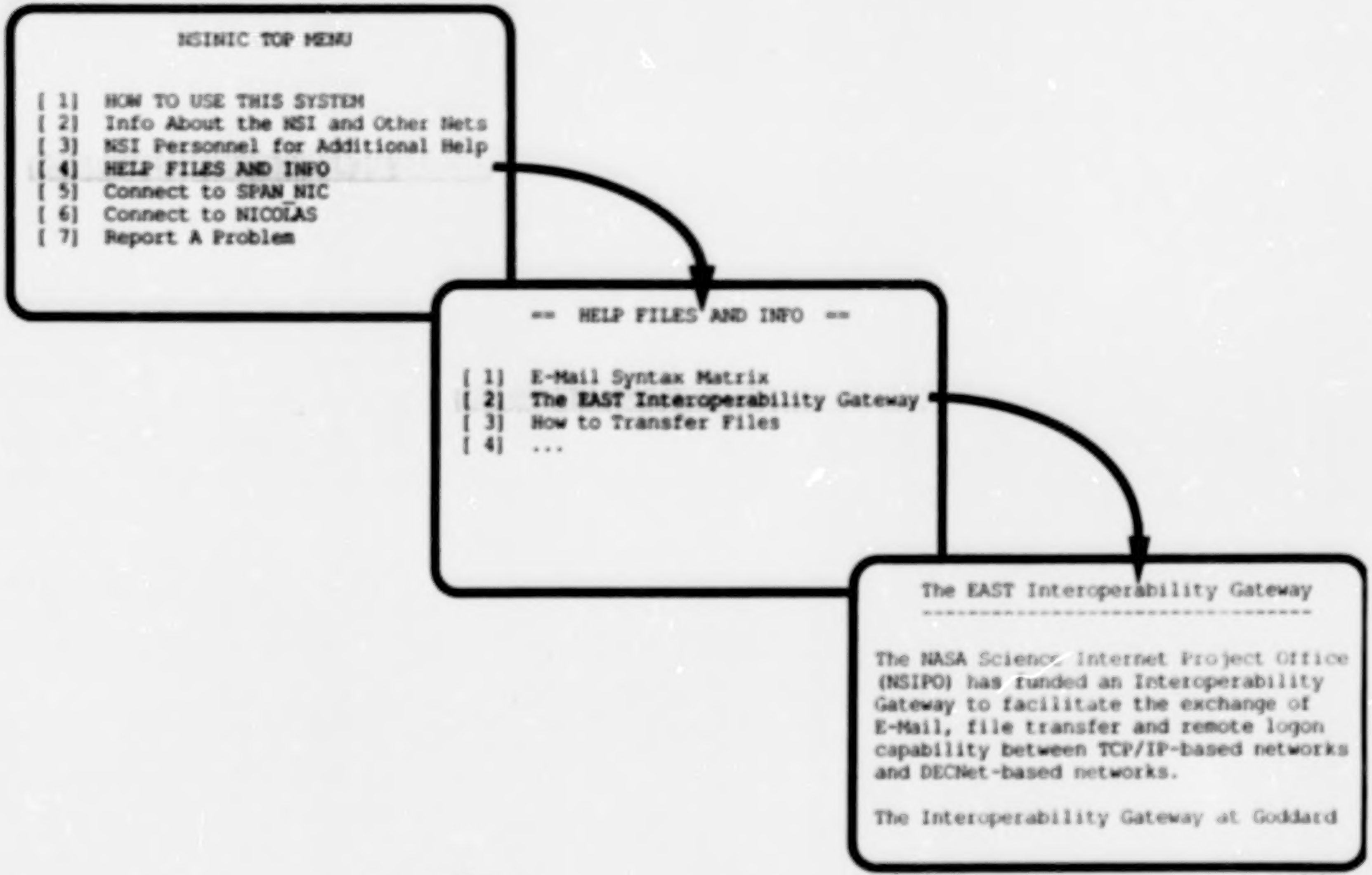
Basically a "skeleton" system that allows easy access to SPAN_NIC and NICOLAS, provides an on-line problem reporting utility, provides information about the NSI and help contacts for individual NASA and ESA sites.

System is hardware independent; NSINIC looks and acts the same on many different kinds of terminals.

User-friendly menu interface.

ADFTO

The NSINIC On-Line System



```
                NSINIC TOP MENU


[ 1]   HOW TO USE THIS SYSTEM
[ 2]   Info About the NSI and Other Nets
[ 3]   NSI Personnel for Additional Help
[ 4]   HELP FILES AND INFO
[ 5]   Connect to SPAN_NIC
[ 6]   Connect to NICOLAS
[ 7]   Report A Problem
```

```
        ==  HELP FILES AND INFO  ==


[ 1]   E-Mail Syntax Matrix
[ 2]   The EAST Interoperability Gateway
[ 3]   How to Transfer Files
[ 4]   ...
```

```
    The EAST Interoperability Gateway
    ---------------------------------

The NASA Science Internet Project Office
(NSIPO) has funded an Interoperability
Gateway to facilitate the exchange of
E-Mail, file transfer and remote logon
capability between TCP/IP-based networks
and DECNet-based networks.

The Interoperability Gateway at Goddard
```

DL 3/8/91

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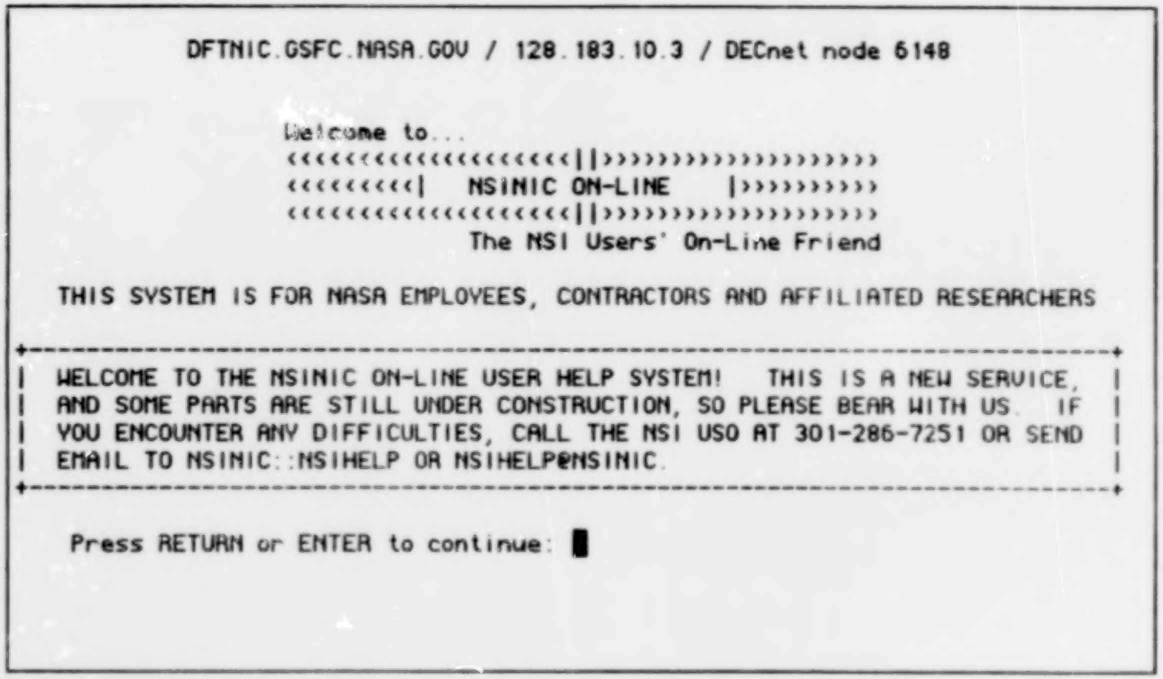
ADFTO

The NSINIC On-Line System

The Welcome Banner:

Once logged in, users are presented with the NSINIC "Welcome Banner", where system messages will be posted as needed.



```
             DFTNIC.GSFC.NASA.GOV / 128.183.10.3 / DECnet node 6148

                         Welcome to...
                         <<<<<<<<<<<<<<<<<<<<<||>>>>>>>>>>>>>>>>>>>>>
                         <<<<<<<<<<|   NSINIC ON-LINE    |>>>>>>>>>>>
                         <<<<<<<<<<<<<<<<<<<<<||>>>>>>>>>>>>>>>>>>>>>
                                      The NSI Users' On-Line Friend

   THIS SYSTEM IS FOR NASA EMPLOYEES, CONTRACTORS AND AFFILIATED RESEARCHERS

+-----------------------------------------------------------------------------+
|  WELCOME TO THE NSINIC ON-LINE USER HELP SYSTEM!   THIS IS A NEW SERVICE,   |
|  AND SOME PARTS ARE STILL UNDER CONSTRUCTION, SO PLEASE BEAR WITH US.  IF   |
|  YOU ENCOUNTER ANY DIFFICULTIES, CALL THE NSI USO AT 301-286-7251 OR SEND   |
|  EMAIL TO NSINIC::NSIHELP OR NSIHELP@NSINIC.                                |
+-----------------------------------------------------------------------------+

    Press RETURN or ENTER to continue: █
```

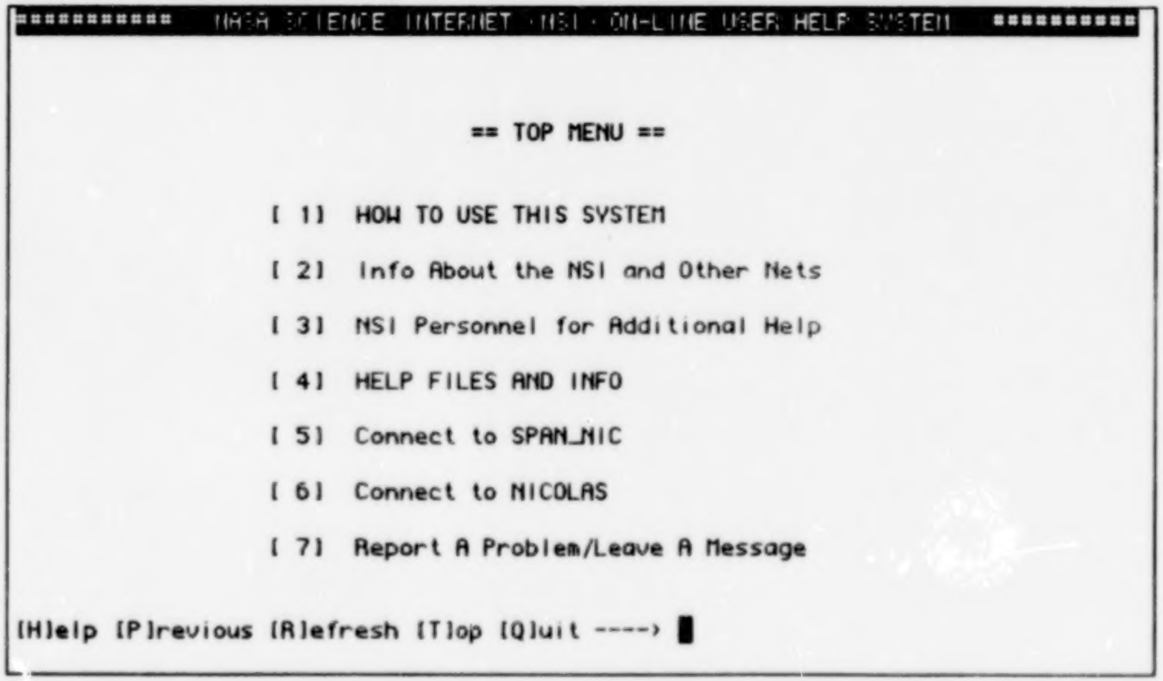
NOTE: Unlike NICOLAS, there are no "passthrus" to other systems available at this point.

DL 2/8/91

The NSINIC On-Line System

The Top Menu:

This menu is the central point from which all NSINIC features can be accessed; it can be reached from any other menu by entering "T" at the prompt.

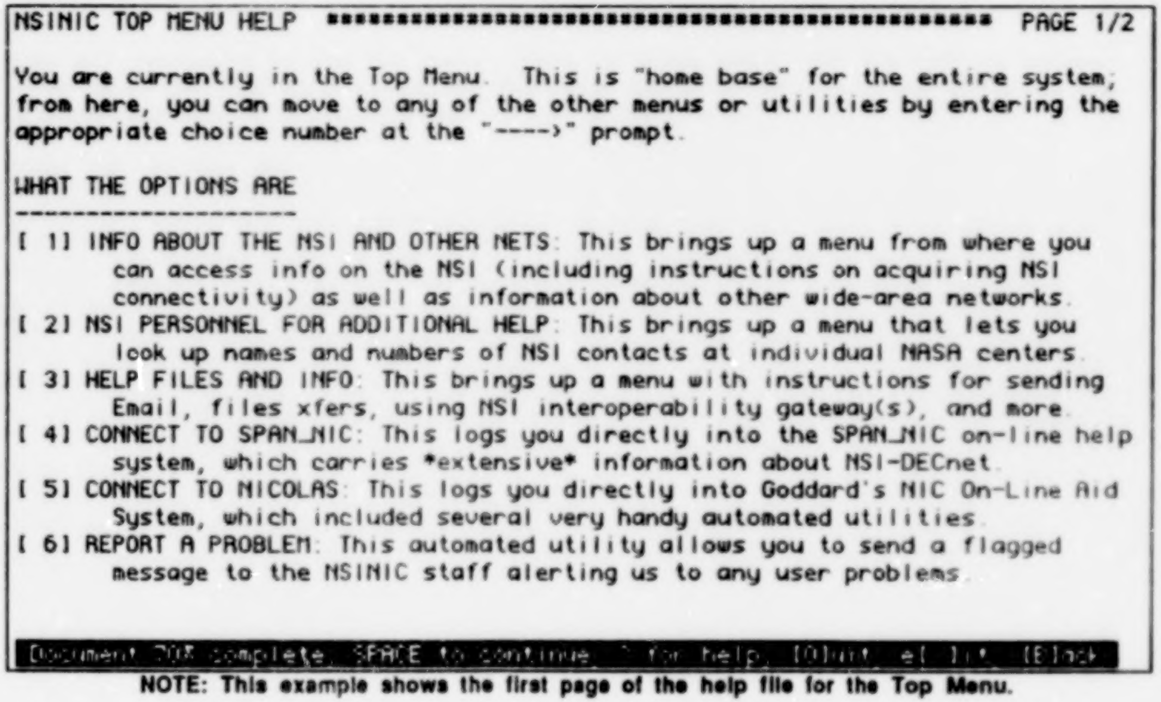


```
###########   NASA SCIENCE INTERNET (NSI) ON-LINE USER HELP SYSTEM   ##########


                              == TOP MENU ==

                 [ 1]  HOW TO USE THIS SYSTEM

                 [ 2]  Info About the NSI and Other Nets

                 [ 3]  NSI Personnel for Additional Help

                 [ 4]  HELP FILES AND INFO

                 [ 5]  Connect to SPAN_NIC

                 [ 6]  Connect to NICOLAS

                 [ 7]  Report A Problem/Leave A Message

[H]elp [P]revious [R]efresh [T]op [Q]uit ---->
```

The NSINIC On-Line System

Menu-Specific Help:

Each menu has its own help file, detailing what the various choices are and listing any system commands available from that menu. These help files can be accessed from any menu by typing "H" at the prompt.



```
NSINIC TOP MENU HELP  ***********************************************  PAGE 1/2

You are currently in the Top Menu.  This is "home base" for the entire system;
from here, you can move to any of the other menus or utilities by entering the
appropriate choice number at the "---->" prompt.

WHAT THE OPTIONS ARE
--------------------

[ 1] INFO ABOUT THE NSI AND OTHER NETS: This brings up a menu from where you
        can access info on the NSI (including instructions on acquiring NSI
        connectivity) as well as information about other wide-area networks.
[ 2] NSI PERSONNEL FOR ADDITIONAL HELP: This brings up a menu that lets you
        look up names and numbers of NSI contacts at individual NASA centers.
[ 3] HELP FILES AND INFO: This brings up a menu with instructions for sending
        Email, files xfers, using NSI interoperability gateway(s), and more.
[ 4] CONNECT TO SPAN_NIC: This logs you directly into the SPAN_NIC on-line help
        system, which carries *extensive* information about NSI-DECnet.
[ 5] CONNECT TO NICOLAS: This logs you directly into Goddard's NIC On-Line Aid
        System, which included several very handy automated utilities.
[ 6] REPORT A PROBLEM: This automated utility allows you to send a flagged
        message to the NSINIC staff alerting us to any user problems.


Document 70% complete, SPACE to continue, ? for help, [Q]uit, e[X]it, [B]ack
```

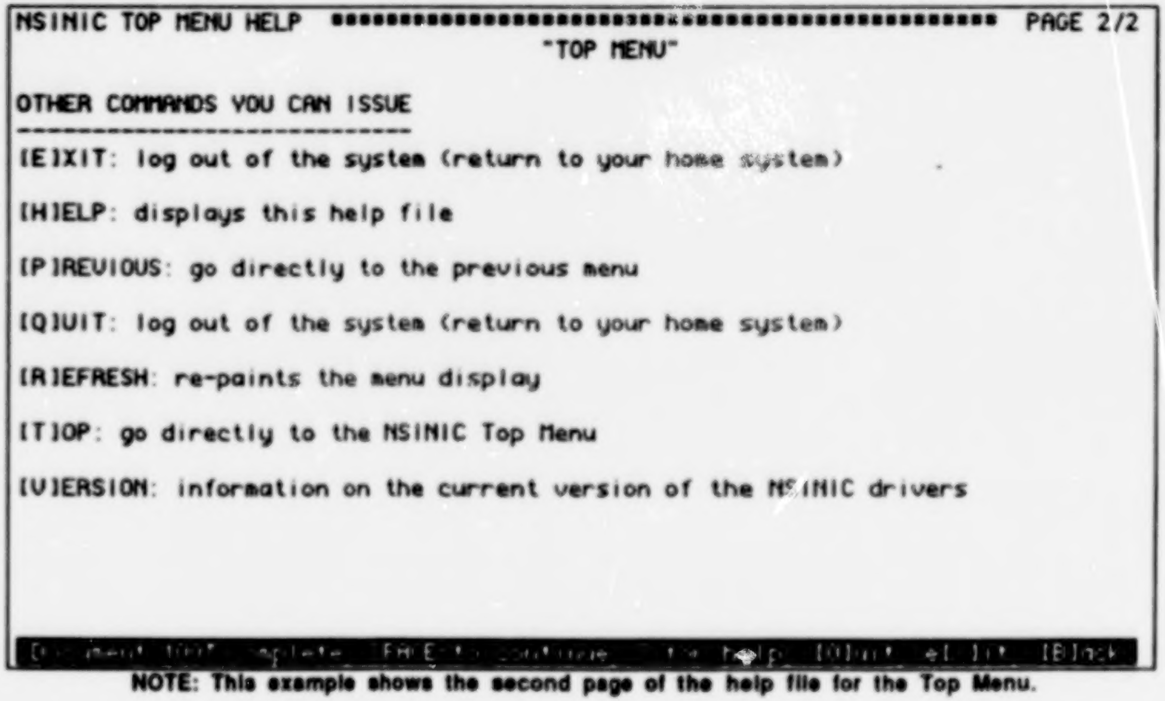
NOTE: This example shows the first page of the help file for the Top Menu.

DL 2/8/91

The NSINIC On-Line System

Menu-Specific Help (cont'd):

This is a sample of the 2nd page of a menu help file, detailing the system commands available from that menu.



```
NSINIC TOP MENU HELP  ********************************************  PAGE 2/2
                                 "TOP MENU"

OTHER COMMANDS YOU CAN ISSUE
----------------------------
[E]XIT: log out of the system (return to your home system)

[H]ELP: displays this help file

[P]REVIOUS: go directly to the previous menu

[Q]UIT: log out of the system (return to your home system)

[R]EFRESH: re-paints the menu display

[T]OP: go directly to the NSINIC Top Menu

[V]ERSION: information on the current version of the NSINIC drivers
```

NOTE: This example shows the second page of the help file for the Top Menu.

DL 2/8/91

ADFTO

The NSINIC On-Line System

NSINIC: The Next Generation

Current plans for the first series of system enhancements concentrate on more information content: more "how to" and "what is" type files, increased coverage of companion wide-area nets, etc.

Other planned enhancements call for inclusion of the SPAN data base and other functions and files from SPAN_NIC, as well as access to TCP/IP information (and possibly other automated utilities).

In the more distant future... an X-based system? Expert system user queries?

The bottom line: NSINIC enhancement and evolution will be driven by *user requirements*.

DL 2/8/91

The NSINIC On-Line System

In Summary...

This is only version 1.0 of a system we expect to grow and evolve over time in reaction to user requests and requirements.

SPAN_NIC will be folded into NSINIC over a period of months, eventually going off-line once the newer NSINIC can furnish an equal level of support to NSI-DECnet users.

NSINIC is only one aspect of the new NASA Science Internet User Support Office (NSI USO) recently established at Goddard; for more information, send electronic mail to NSINIC::NSIHELP (DECnet) or nsihelp@nsinic (TCP/IP).

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PAGE

ADFTO

The NSINIC On-Line System

How to Get There:

To access the NSINIC on-line system from a DECnet node:

```
$ SET HOST DFTNIC <CR>   (If your system does not know DFTNIC, use DECnet
                          address 6148 instead.)
Username:  NSINIC <CR>
```

To access the NSINIC on-line system from a TCP/IP node:

```
$ TELNET DFTNIC <CR>   (If your system does not know DFTNIC, use TCP/IP
                        address 128.183.10.3 instead.)
Username:  NSINIC <CR>
```

RL 2/8/91

ADFTO

WHO YOU GONNA CALL?

NASA Science Internet User Support Office
(NSI USO) Code 930.4
Advanced Data Flow Technology Office
Goddard Space Flight Center
Greenbelt, MD 20771

301-286-7251 FTS 888-7251
(alt. 301-286-9514/FTS 888-9514)
(FAX 301-286-5152)

DFTNIC::NSIHELP (6148::NSIHELP)
nsihelp@dftnic.gsfc.nasa.gov (nsihelp@128.183.10.3)
(C:USA,A:TELEMAIL,P:INTERNET,ID:"<nsihelp(a)dftnic.gsfc.nasa.gov>")
NSIHELP@DFTBIT

BL 2/8/91

The NSI User Support Office (NSIUSO) Presents...

THE NASA SCIENCE INTERNET NETWORK INFORMATION CENTER (NSINIC) ON-LINE SYSTEM

NSINIC is a menu-driven help facility designed to aid both novice and experienced users of the NASA Science Internet. NSINIC includes user guides for general and inter-operating networking functions (e.g., remote logins and file transfers); listings of who to call for help at individual NASA centers; and general information about the NSI. Automated utilities within NSINIC provide transparent access to on-line help and other systems. Users are encouraged to access the NSINIC on-line system and leave comments.

Accessing NSINIC:

...from a TCP/IP System: TELNET to DFTNIC.gsfc.nasa.gov (128.183.10.3); username is NSINIC.

...from a DECnet System: SET HOST to DFTNIC (DECnet address is 6148); username is NSINIC.

...via Dial-Up Links: Dial the appropriate access number as shown in the following table (all are area code 301), then follow the instructions listed below:

Speed	Parity	Bit Settings	Telephone	Notes
300-2400	ODD/NONE	8 d/1 s or 7 d/2 s	286-9000	All these modems automatically set
300-2400	EVEN	7 data/1 stop	286-9500	themselves for the correct speed.
9600	NONE	8d/1s or 7d/2s	286-4000	Only 8 are available.
9600	EVEN	7 data/1 stop	286-4500	Only 4 are available.

System Prompt	You Type...	
CALL, DISPLAY, OR MODIFY?	CALL SISC <CR>	[NOTE: If dialing from off-GSFC, you will see "ENTER NUMBER" instead!
DIALING nnnnn		
CALL COMPLETE	<CR> <CR>	
Enter username>	(type your name here) <CR>	
(misc. system messages)		
Local>	C DFTNIC <CR>	
(misc. system messages)		
Username:	NSINIC <CR>	

...via SprintNet (X.25) Links: Dial your local SprintNet (formerly Telenet) access number, then hit [RETURN] or [ENTER] several times until you see the "@" prompt. (Information on local SprintNet access is available from the NSIUSO.) *NOTE: If you are dialing in to SprintNet, you will need a NASA Packet Switched System (NPSS) DACS userid; contact the NSIUSO for more information.*

System Prompt	You Type...
@	C NASA
"CONNECTION ESTABLISHED"	<CR> <CR>
(misc. system messages)	
*	LOGON <CR>
ENTER USERID>	(your DACS ID) <CR>
ENTER PASSWORD>	(your DACS p/w) <CR>
ENTER SERVICE>	DFTNIC <CR>
(misc. system messages)	
Username:	NSINIC <CR>

Questions and/or comments about the NSINIC may be e-mailed to the account name "NSIHELP" at any of the following:
DECnet: DFTNIC (6148)   TCP/IP: dftnic.gsfc.nasa.gov (128.183.10.3)   BITNET: dftbit

NASA Science Internet User Support Office
Advanced Data Flow Technology Office
Code 930.4
NASA Goddard Space Flight Center
Greenbelt, MD 20771
301-286-7251 or FTS 888-7251

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PAGE

The Internet Resources Guide

and

The Automatic Login Executor (ALEX)

J. Patrick Gary
Advanced Data Flow Technology Office
Code 930.4
Goddard Space Flight Center

Presentation to
NASA Science Internet User Working Group
February 12, 1991

INTERNET RESOURCE GUIDE

NSF Network Service Center (NNSC)
BBN Systems and Technologies Corporation
10 Moulton Street
Cambridge, MA 02138
nnsc@nnsc.nsf.net

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The Internet Resource Guide is compiled by the NSF Network Service Center (nnsc@nnsc.nsf.net) at BBN Systems and Technologies Corporation from contributions by members of the Internet community. This work is supported by a subcontract with the University Corporation for Atmospheric Research (UCAR), which operates under agreement with the National Science Foundation (NSF). The editors have made reasonable efforts to provide correct information, but neither UCAR, NSF, NNSC nor BBN is responsible for the accuracy of the listings in this guide. Copyright 1989 BBN Systems and Technologies Corporation.

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INTERNET RESOURCES GUIDE

		NUMBER OF ENTRIES	
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CHAPTER 3:	ARCHIVES	15	18
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Chapter 2: Library Catalogs

A large number of libraries allow access to their library catalogs via the Internet. Such catalogs can be very useful for finding uncommon books not available at a local library. Once a book is located, it can often be borrowed by your local library through Interlibrary Loan. Another popular use of library catalogs is to check citations or references. Many catalogs also support more extended reference facilities.

Please note that on-line catalogs often have a limited number of ports. Users are asked not to abuse their access.

We would like to acknowledge the considerable assistance of Ron Larsen, Art St. George, and Joe St. Sauver in compiling this section.

Contents

Boston University (TOMUS) 2.1
Univ. California and California St. (MELVYL) 2.2
Colorado Alliance of Research Libraries 2.3
Research Libraries Information Network (RLIN) 2.4
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MIRLYN, The University of Michigan's Online Catalog 2.6
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Emory University Libraries Online
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MAGIC 2.9
Info-Lib 2.10
InfoTrax 2.11
ARLO, The Library Catalog for the University of
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    Madison and Milwaukee Campuses
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University of Utah Library
    Card Catalog System 2.15
Northwestern University LUIS Online Catalog 2.16
URSUS, University of Maine System
    Library Catalog 2.17
University of Illinois at Chicago
    NOTIS/LUIS 2.18

MAGIC

Address:
Michigan State University Libraries
East Lansing, MI 48824-1056

E-mail: Thomas Albright, Head Library Systems: 20676tea@msu.bitnet

Phone: 517-383-8700 (MSU Libraries Information/Reference)

Description

MAGIC is a computer-based library catalog of more than 1.3 million unique book, serial, microform, and other non-book titles in the Michigan State University Libraries.

Network Access

To access using IBM 3270 emulation:

TN3270 to magic.msu.edu (35.8.2.99).
At the VM 370 screen press the *enter* key.
At the logon screen enter "Dial MAGIC".
Press *enter* to get the MAGIC introductory screen.
To exit from MAGIC, use your local escape sequence to return to the TN 3270 program and close the network connection.

To access using Telnet (VT100, VT200 emulation):

Telnet to merit.msu.edu (35.8.2.56).
Enter "MAGIC" at the "Which Host?" prompt.
Enter "VT100" as your terminal type. The MAGIC introductory screen will be displayed.
To exit from MAGIC, press *CTRL-E* and then enter "%quit"

Who Can Use the Resource

MAGIC is available to anyone, without any restrictions.

Miscellaneous Information

For questions concerning network access contact:

Computing Information Center
MSU Computing Laboratory
consult@msu.edu
(517) 353-1800

For written instructions on how to use MAGIC, write to :

MSU Libraries
Information/Reference
(517) 353-8700

The information in this section is provided in accordance with the copyright notice appearing at the front of this guide.

How to Get and Use
the
INTERNET RESOURCE GUIDE

This README document contains, first, a discussion of the Internet Resource Guide, and then (for those who need them), nitty-gritty details about PostScript files, FTP, and the Unix commands "compress," "uncompress," and "tar."

The Internet Resource Guide hierarchy is organized as follows.

Material is divided up into chapter and section. Each chapter has its own directory, and each section has its own files, one for PostScript and one for plain text.

So, to retrieve section 1.1 of chapter 1, you should FTP the files

```
resource-guide/chapter.1/section1-1.ps  (Postscript)
resource-guide/chapter.1/section1-1.txt  (Text)
```

To simplify retrieval of entire chapters and chapter updates, or of the entire resource guide, you can FTP compressed tar files. The tar files for individual chapters include the recently updated sections, and both the PostScript and text files.

```
resource-guide/chapter1.tar.Z
```

The most recent changes to a chapter are in a file named chapter#-changes.tar.Z. These include only the most recently updated sections!

INTERNET RESOURCES GUIDE AVAILABILITY

- The Internet Resources Guide (IRG) is available
  via anonymous ftp from
  nnsc.nsf.net
  in the /resources-guide directory

- **The "How to Get and Use the IRG" README file**
  is available
  via anonymous ftp from

  a) nnsc.nsf.net in the /resources-guide directory as file README

  b) dftsrv.gsfc.nasa.gov. in the /pub directory as file README-resource-guide

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PAGE

Automatic Login Executor (ALEX)

Overview

- Designed to perform remote logins to most resources listed in the Internet Resource Guide.(1)

- Operates with menus, and provides a help screen.

- Uses the telnet utility, so that the login is transparent to the user.

- Implemented as "standalone"(2) software which users copy and/or ftp to their workstation.

- Written in two different languages, DCL and C shell, so that both VMS and UNIX based workstations can utilize it.

- Also known as the Son of NICOLAS.

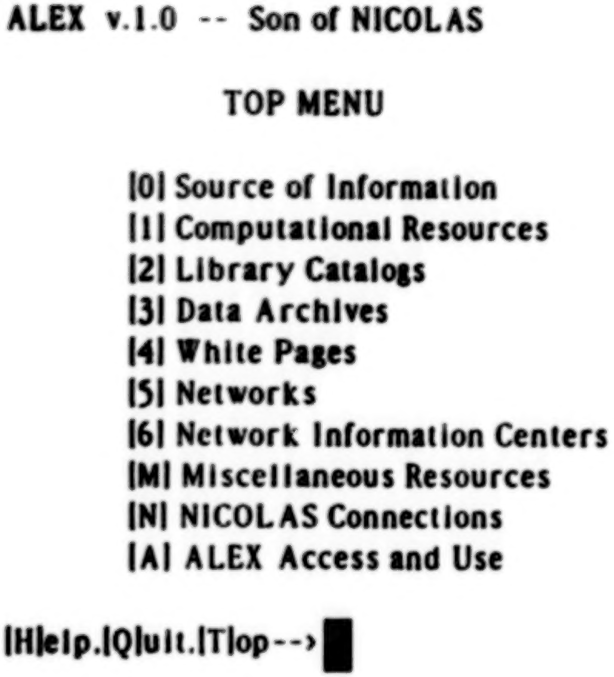
(1) As of July 1990
(2) Assumes user workstation has TCP/IP-based telnet capability

ALEX Implementations*

DCL Version	C shell Version
Written for VAX computers running VMS with MultiNet.	Written for computers with the UNIX operating system.
Total of 143 files.	Total of 152 files.
Main Driver is ALEX.MAIN.	Main driver is alexu.
Specialized comfiles to clear the screen, use a more utility, etc.	Various executable files that clear the screen, accept input, etc.
Remaining text and comfiles refer to a specific host.	The remaining text and executables refer to a specific host.

* Version 1.0 codes for both the DCL and C shell versions were developed by James Landry/USRA/930.4

Top Menu of ALEX



```
ALEX v.1.0 -- Son of NICOLAS

              TOP MENU

        [0] Source of Information
        [1] Computational Resources
        [2] Library Catalogs
        [3] Data Archives
        [4] White Pages
        [5] Networks
        [6] Network Information Centers
        [M] Miscellaneous Resources
        [N] NICOLAS Connections
        [A] ALEX Access and Use

[H]elp.[Q]uit.[T]op-->
```

Library Menu of ALEX

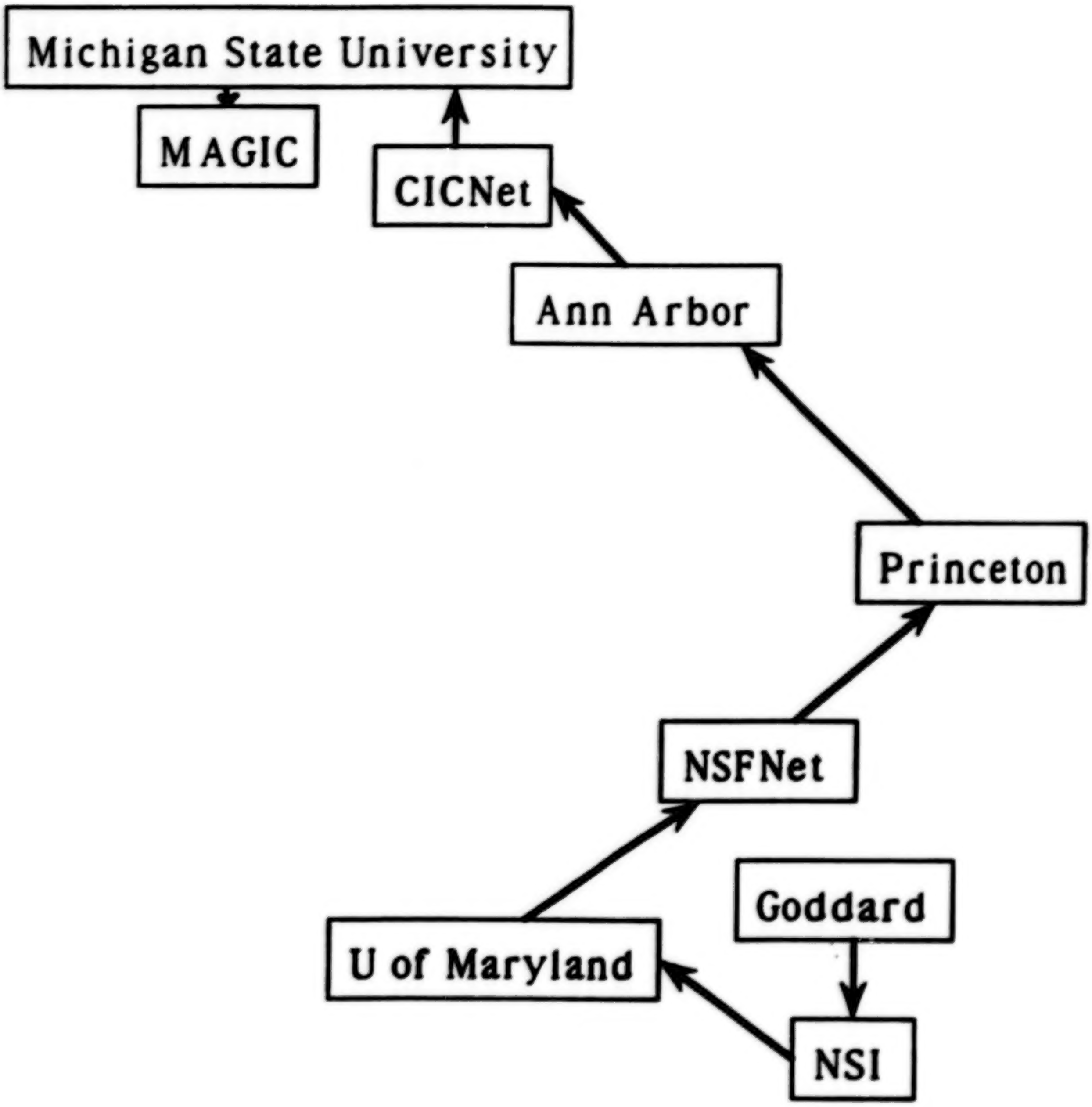
```
ALEX v.1.0 -- Son of NICOLAS

                 Library Catalogs Menu
             (All of these choices to edify yourself)

      [2_01] Boston University (TOMUS)
      [2_02] Univ. California and California St. (MELVYL)
      [2_03] Colorado Alliance of Research Libraries
      [2_04] Research Libraries Information Network (RLIN)
      [2_05] Florida Center for Library Automation
      [2_06] MIRLYN. The University of Michigan's Online Catalog
      [2_07] University of New Mexico Gateway
      [2_08] Emory University Libraries Online Public Access   Catalog
      [2_09] MAGIC
      [2_10] Info-Lib
      [2_11] InfoTrax
      [2_12] ARLO. The Library Catalog for U of C at Colorado Springs
      [2_13] The Catalog of the University of Pennsylvania Libraries
      [2_14] U of W Madison and Milwaukee Network Library System (NLS)
      [2_15] University of Utah Library Card Catalog System
      [2_16] Northwestern University LUIS Online Catalog
      [2_17] URSUS. University of Maine System Library Catalog
      [2_18] University of Illinois at Chicago NOTIS/LUIS

[H]elp.[Q]uit.[T]op--> █
```

Example of ALEX Selection 2_09

```
ALEX  v.1.0 (JWL) -- Son of NICOLAS

Warning:
It is very difficult to get out of MAGIC.
Let the user beware...
The people who designed MAGIC say the best way to get out is to type
Control E and then enter '%quit'.
If you wish to leave, input 'e'.

Press any other key to continue...

Okay, you asked for it.
We're going into MAGIC now...

     ($ telnet 35.8.2.56
      MAGIC
      VT100
      $ exit)
```

The Path of ALEX

Selection 2_09


Michigan State University
MAGIC
CICNet
Ann Arbor
Princeton
NSFNet
Goddard
U of Maryland
NSI

ALEX Availability

- The file README-alex containing "Access and Use of the Automatic Login Executor (ALEX) is available via anonymous ftp from dftsrv.gsfc.nasa.gov in the /pub directory
- The DCL version of ALEX for VMS systems is available
  1) via anonymous ftp from:
  a) dftsrv.gsfc.nasa.gov in the /alex/dcl-alex directory
  b) dftnic.gsfc.nasa.gov in the alex directory
  2) via DECnet copy from:
  dftnic::cldata:[anonymous-ftp.files.alex]
- The C shell version of ALEX for UNIX systems is available via anonymous ftp from dftsrv.gsfc.nasa.gov in the /alex/csh-alex directory

NSI Conference Support

Susan Aaron (NSI/Sterling Software)
February 13, 1991

One of the many services NSI provides as an extension of customer/user support is to attend major scientific conferences. The conference effort provides NASA/OSSA scientists with many benefits.

- Scientists get to see NSI in action. They utilize the network to read email, and have recently begun to demonstrate their scientific research to their colleagues.
- Scientists get an opportunity to meet and interact with NSI Staff; most notably Customer Service Representatives. This gives scientists a chance to get status on their requirements, ask about network status, get acquainted with our procedures, and learn about our services.
- Scientists are exposed to networking in a larger sense; particularly by learning about other NASA groups who provide valuable scientific resources over the Internet.

A Perspective

At first, there were minimal support mechanisms in place to conduct this endeavor. My job was to define, coordinate, and supervise the effort.

First, we needed to decide what type of services we wanted to provide, along with how we wanted NSI to promote those services. Of course, we needed practical mechanisms to make it happen successfully.

Goals in this area were:

To develop a program under which NSI could provide the necessary support at major scientific conferences, including:
- Defining support criterion
- Defining strategies for promoting NSI services
- Establishing practical mechanisms for success

Support Criterion

Basic criterion for attending conferences was established early in 1990 with supervision and direction from NSI Customer Service Manager Christine Falsetti.

- There must be a large NASA/OSSA contingent.
This ensures that we will be reaching our designated user communities. It also makes the effort more cost effective.

- NASA disciplines request an NSI presence.
When NSI is supporting a specific scientific project,we might be asked to attend a conference to highlight and support a particular scientific effort. (i.e.. Galileo, TOS)
Because NSI has MOU's and requirements with all of the OSSA disciplines, we are getting more requests from Discipline and Division heads. . *We are often directed to support a conference at the NASA Headquarters Program level.*

2. Services

- Educational Service

NSI conveys its services at conferences by means of effective presentation materials, documentation, and informed booth participants.
A large, freestanding backdrop is set up on which are mounted photos representing the scientific disciplines we are there to support. We now have two portable backdrops, and have a growing collection of display materials. NSI "stickers" depicting our logo are given away as 'freebies'.

NSI has produced new documentation which describes the mission of the project and also provides information on how to use our services (and the Internet in general).
A complete NSI bibliography has recently been developed which we make available to users at conferences. Follow-up after conferences involves mailing users the documents which were requested. (We have mailed over 4000 email matrices as of this month.)

Documentation Includes:

NSI brochure	NSI/NASA	Sterling Software
Electronic Mail Matrix	Joan Thompson	Sterling Software
Using the Interoperability Gateway	Susan Aaron	Sterling Software
Internet Resource Guide	BBN Technologies	Cambridge, Mass
OSI in the NASA Science Internet- An Analysis	Rebecca Nitzan	Sterling Software

We are a regular contributor to the OSSA newsletter and have recently contributed major articles to EOS (magazine for the AGU) and the AAS newsletter. We are represented in all conference program announcements.

- **NSI Staff Participation**

Customer Service Representatives play a major part in making the conference a success. Because they are the individuals most involved with specific scientific disciplines, they are the primary resource to impart information (like the status of requirements) to scientists who are in attendance at the conference. Their presence affords our users the chance to meet their advocates in person; a big help in establishing lines of communication.

We also do a limited amount of informal training at the exhibit booth. An example of this is our instruction on how to use the Interoperability Gateway.

NASA/NSI management also participate in conferences.
At recent AGU and AAS meetings, special informational forums were conducted by Fred Rounds (Project Manager), Christine Falsetti (Customer Service Manager),and Tony Villasenor (Program Manager).

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-Network Service

Because we are a service organization dedicated to providing NASA networking, it is appropriate for us to create an environment at conferences that accurately reflects the service we provide. This means providing network access.

NSI engineering is responsible for all the technical aspects of conference support; including network architecture, configuration, and routing. Our installation group procures equipment, ships it to the conference site, and tests it before the conference. We rely on our NOC for 24X7 coverage of the line at the conferences.

NSI funds the necessary line procurement and coordinates with other NASA centers (where possible) and other organizations to ensure the line is dropped at the correct location and can be tested before the conference.

NSI now provides network support at most conferences. Our basic service is to allow conference participants email access via the Internet; we bring a set of equipment to accommodate the customer requirement.

Recently, we have provided networking as a **value-added** service to scientists and scientific organizations wishing to demonstrate databases, and now, image files via the network. This value-added service is evaluated at the Project and Program level, and is provided on a case-by-case basis.

Some, but not all, of the scientists supported this year are listed below:

Dr. Tom Renfrow	Planetary Data System (PDS)	LPSC 4/90
Dr. Chuck Acton	PDS/NAIFS Database	LPSC 4/90
Dr. Joy Beier	NSSDC/NASA Master Directory	AGU 12/89,5/90,12/90
Dr. Michael Garcia	Smithsonian Astrophysics Observatory	AAS 6/90,1/91
Dr. George Helou	NASA Extragalactic Database	AAS 6/90.1/91
Dr. Elizabeth Bouten	OCEANIC Database	AGU 12/90
Mr. Ted Clarke	Galileo Earth Encounter	AGU 12/90
Dr. John Good	Astrophysics Data System	AAS 1/91

This year, NSI has successfully supported 13 conferences. The complete list follows:

NSI Conferences **Fiscal 1990-91**

Conference/Discipline	Location	Date	Attendance	Networking	NASA Groups Supported
American Geophysical Union (AGU Fall Meeting) **Multidisciplinary** **Space Physics**	San Francisco CA	12/89	6000+	yes modems/9.6	
Lunar Planetary Science Conference **Solar and Planetary**	Houston TX	3/90	3000	yes JSC Ethernet NSI routing	PLDS NAIFS LPI
PSCN Conference **Networking**	Monterey CA	4/90	400	yes modems/2400	PSCN
Geoinfo **Life Science**	Montreal Canada	5/90	2000		International Life Science
AGU (Spring Meeting) **Multidisciplinary** **Space Physics**	Baltimore MD	5/90	1000	yes modems	collaboration with NASA Master Directory (NSSDC)
American Astronomical Society (Spring Meeting) **Astrophysics** **Solar Physics**	Albuquerque NM	6/90	3000	yes 56Kbps NM Technet	SAO NED (Sun Microsystems*) NASA Master Directory

NSI Conferences **Fiscal 1990-91**

Conference/Discipline	Location	Date	Attendance	Networking	NASA Groups Supported
Evolution and Origin of Life Conference **Life Science**	NASA Ames	7/90	300	yes Ames Ethernet NSI routing	SETI
Division for Planetary Science **Planetary**	Charlottsville NC	10/90	800	yes 56Kbps	PDS
AGU (Fall Meeting) **Multidisciplinary** **Space Physics**	San Francisco CA	12/90	8000	yes T1	Galileo OCEANIC NASA Master Directory
American Meteorological Society **Earth Science**	New Orleans LA	12/90	2000		collaboration with NASA Master Directory
AAS (Fall Meeting) **Astrophysics** **Solar Physics**	Philadelphia PA	1-91	6000	yes 2 56Kbps, UPenn	SAO ADS NED SIMBAD HEASARC Multiwave
NSI Users Working Group **Networking**	San Mateo CA	2-91	150	yes 56Kbps	X.500 White Pages* TGV, Incorporated* CRUSH COSMIC PLDS NSI Operations
The Oceanography Society **Earth Science**	St. Petersburg FL	3/91	1000*	yes T1	NODS NODC NASA Master Directory NOAA AVHRR CZCS

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CRUSH: The NSI Data Compression Utility

Ed Seiler (STX/GSFC Code 935)

February 13, 1991

CRUSH : The NSI Data Compression Utility

CRUSH is a data compression utility that provides the user with several lossless compression techniques available in a single application. CRUSH was originally developed for the NSSDC as a result of requests for such a package from a users working group meeting. It is intended that the future development of CRUSH will depend upon feedback from the user community to identify new features and capabilities desired by the users.

CRUSH provides an extension to the UNIX Compress program and the various VMS implementations of Compress that many users are familiar with. An important capability added by CRUSH is the addition of additional compression techniques and the option of automatically determining the best technique for a given data file.

The CRUSH software is written in C and is designed to run on both VMS and UNIX systems. VMS files that are compressed will regain their full file characteristics upon decompression. To the extent possible, compressed files can be transferred between VMS and UNIX systems, and thus be decompressed on a different system than they were compressed on.

Version 1 of CRUSH is currently available from the NSSDC. This version is a VAX VMS implementation. Version 2, which has the full range of capabilities for both VMS and UNIX implementations, will be available shortly. A VMS Backup file containing the source of version 1 is available at NSSDCB::ANON_DIR:[PUBLIC]CRUSH.BCK, and equivalently via anonymous FTP at NSSDCA.GSFC.NASA.GOV. It is anticipated that version 2 will be made available through the NSINIC. Watch for an annnouncement soon.

CRUSH has been developed as part of the research of data compression techniques for the Configurable High-Rate Processor project at NASA Goddard Space Flight Center. Edward Seiler, of ST Systems Corp. is the developer of the software, and can be contacted via E-mail at SEILER@AMARNA.GSFC.NASA.GOV

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CRUSH

The NSI Data Compression Utility

Features:

- Compresses VMS and UNIX files, and keeps VMS file characteristics upon decompression

- Can compress single files or entire directories

- Extends the capabilities of the CMPR and COMPRESS programs

- (Currently) provides 3 different methods, or automatic selection of the method that provides the best compression. More methods available soon

- Compressed files can be recognized either from a file extension with _c appended, or by finding ASCII “CRUSHED” in first 7 bytes

- Will decompress files that were compressed by UNIX COMPRESS

Usage Considerations:

- Except for ASCII headers, compressed files are binary, so they cannot be printed
- Three methods available:
  - Lempel-Ziv-Welch (LZW) : just as used in CMPR, it's relatively fast
  - Witten-Neal-Cleary (WNC) : uses arithmetic coding
  - Adaptive WNC : usually slower than LZW but often compresses better
- Automatic "method" tries each method for a file (or a sample section of a large file) and chooses the best one, but this may take a while
- Decompressor figures out which method to use by itself

Usage

CRUSH filename(s)

- a single filename, a list of filenames, and wildcards may be used
- user will be prompted if filename omitted
- if file is named “myfile.dat”, compressed file will be named “myfile.dat_c”

/METHOD = { lzw | wnc | adap | auto }

- lzw : Lempel-Ziv-Welch
- wnc : Witten-Neal-Cleary
- adap : Adaptive WNC
- auto : all of the above are tried

/DELETE

- delete “myfile.dat” after “myfile.dat_c” is created

/OUTPUT = filespec

- CRUSH /OUTPUT=[mydir.dir] *.* compresses all files and directs them to the subdirectory [mydir.dir]
- CRUSH/OUTPUT=TT: directs uncrushed output to the terminal

UNCRUSH filename

- for a crushed file named “myfile.dat_c”, generates the uncrushed file “myfile.dat”

/OUTPUT = filespec

- UNCRUSH/OUTPUT=goofy.name myfile.dat_c renames the uncrushed file to “goofy.name”

ELECTRONIC SOFTWARE SUBMITTAL/DISTRIBUTION

L. Scott Clark
Assistant Director

sclark
scott@cossack.cosmic.uga.edu
(404) 542-3265

NASA

COSMIC OVERVIEW

Historical Background

- 1958 Space Act
- COSMIC Founded in 1966
- Contracted out of Code CU at Headquarters
- NMI 2210

ELECTRONIC SOFTWARE SUBMITTAL/DISTRIBUTION

COSMIC OVERVIEW

COSMIC Now

- Functional Divisions
- Available Computing Resources
- Inventory Composition
- Characterization of Customers
- Promotional Efforts

COSMIC OVERVIEW

COSMIC
And The Software Innovator

- Technology Utilization Offices
- Software Submittal
- Program Checkout And Evaluation
- Tech Brief Awards

SUBMITTAL/DISTRIBUTION ISSUES

Connectivity

Software Submittals

- Coordination Of Submittal With TUO Transmittal Documents
- Documentation
- Authorization/Security
- COSMIC ↔ Author Communication
- Research or Pilot Codes

SUBMITTAL/DISTRIBUTION ISSUES

Software Distribution

- NASA vs Outside Customers
- Documentation
- Ordering
- Authorization/Security
- Intellectual Property Rights

ELECTRONIC SOFTWARE SUBMITTAL/DISTRIBUTION

SUBMITTAL/DISTRIBUTION ISSUES

Solicitation
Of Input/Feedback

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IV. Exhibit Information Handouts

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A. NASA Master Directory

NSSDC
NATIONAL
SPACE
SCIENCE
DATA
CENTER

WORLD DATA CENTER A for ROCKETS AND SATELLITES 89-19

The NASA Master Directory

CATALOG
CI
INTEROPERABILITY

Quick Reference Guide

November 1989

NASA
National Aeronautics and
Space Administration

Goddard Space Flight Center

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NASA MASTER DIRECTORY QUICK REFERENCE GUIDE

1. INTRODUCTION TO THE MD

The NASA Master Directory (MD) is a free, online, multidisciplinary directory of space and Earth science data sets (NASA and non-NASA data) that are of potential interest to the NASA-sponsored research community. The MD contains high-level descriptions of data sets, other data systems and archives, and campaigns and projects. It provides mechanisms for searching for data sets by important criteria such as geophysical parameters, time, and spatial coverage. The MD also provides information on ordering the data.

The MD is *more* than just a directory, however. In order to simplify the process of finding more detailed information or accessing online data, the MD provides automatic connections to a number of data systems such as the NASA Climate Data System, the Planetary Data System, the NASA Ocean Data System, the Pilot Land Data System, and others. The MD also provides general information about many data systems, data centers, and coordinated data analysis projects. It represents the first major step in the Catalog Interoperability project, whose objective is to enable researchers to quickly and efficiently identify, obtain information about, and get access to space and Earth science data.

To learn how to get to the MD, see section 2. If you have trouble accessing the MD, or if you have questions regarding the NASA Master Directory or Catalog Interoperability, please contact Jim Thieman at (301) 286-9790 or Joy Beier at (301) 794-5289.

Features of the MD include:

- Capability of searching for data sets by any combination of keywords (discipline, location, geophysical parameter), start and stop dates, spacecraft or data source, sensor, geographic coverage, scientific project, and investigator;
- Easy-to-use menu, command, and screen-form interface that can be used with most terminal types (including smart and dumb terminals);
- Displays of data set information including title, summary, keywords, temporal and spatial coverage, archive information, data set personnel, and bibliographic references;
- Displays of data center information including data center services, contacts, access procedures, available distribution media, and costs;
- Displays of science project information such as scientific objectives, data characteristics, and contacts;
- Automatic connections to selected data systems or catalogs through a simple LINK command; and
- HELP from every MD screen.

2. ACCESSING THE MD

LOG ONTO THE NSSDC VAX 8650

Via SPAN

From SPAN nodes, enter **SET HOST NSSDCA** from the **$** prompt and enter **NSSDC** at the **Username**: prompt (there is no password).

Via Direct Dial

Set your terminal to full duplex, eight bits, no parity, one stop bit, and 300, 1200, or 2400 baud. Dial 301-286-9000. When the system responds with **CONNECT 1200** (or 300 or 2400), press return twice. At the **ENTER NUMBER:** prompt enter **MD** for the MD system. When you see the message **CALL COMPLETE**, press return for the **Username:** prompt. At the **Username:** prompt enter **NSSDC** (there is no password).

Via Telnet

From a Telnet node, enter **TELNET NSSDCA.GSFC.NASA.GOV** or **TELNET 128.183.10.4** at the system prompt. Enter **NSSDC** at the **Username**: prompt (there is no password).

SELECT THE NASA MASTER DIRECTORY OPTION FROM THE NSSDC MENU (Option #1)

The MD main menu will be displayed. From this menu you can select options to search for data set, data center, or project information (see the menu tree diagram at the end of the guide).

SELECT A SEARCH OPTION FROM THE MD MAIN MENU

Enter the number corresponding to the desired search option (data set, data center, or project information searching).

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3. DATA SET SEARCHING

Data Set Information

CHOOSE YOUR DESIRED SEARCH CRITERIA

A search selection menu displays the available search criteria. Select the criteria that will identify data of interest (e.g., if specific geographic coverage is an important constraint to your data need, that would be one of the options you enter). It is usually better to begin a search with a minimum of criteria and then later use more as necessary. When using a combination of criteria (e.g., combining parameter keywords, sensors, sources, and temporal and spatial coverage), it is strongly recommended that you include discipline (space physics, Earth science, etc.) as one of your criteria. This inclusion may help focus the results of your search.

If temporal or spatial coverage or investigator is not critical to your research needs, you may want to use the multiple keyword option, which allows you to search all keyword fields (discipline, parameter, etc.) using several keywords. An **AND** or **OR** may be used in the query. There are no valid lists available with the multiple keyword search option; so searching with the discipline, parameter, and location keywords might be better if you are unfamiliar with the MD. It is usually better to specify a few simple keywords or even parts of words (e.g., **MAG** rather than **MAGNETOMETER**) rather than several compound keywords when using the word search option, which is not a full-text search system.

After entering the desired search keys, the keyword entry form will be displayed.

ENTER THE DESIRED VALUES

With smart terminals, your cursor will be positioned in the entry field; with line mode terminals, you will be prompted for the field value. Enter the value and press return. The cursor or prompt will then move to the next field. Entering a ? will give a list of valid values from which a choice may be made. Once all values are entered, the cursor or prompt will move to the **COMMAND** prompt. You can then enter **SEARCH** to start the search, or you can return to the fields to change a value by entering a period or by pressing return.

NOTE: The MD will return any values that match the characters entered. For example, if you enter **NITR**, values such as *nitrogen*, *nitrogen dioxide*, *nitric acid*, etc., will be considered to match the specified criteria.

Search Criteria Form

Lists of valid values are available for the following fields:

Discipline
Parameter group
Sensor (instrument)
Location
Subdiscipline
Parameter
Source (e.g., spacecraft)
Project

When entering values in these fields, the MD will automatically check to see if the value entered is valid. If it is not, a list of available values will be displayed, and you can select the number corresponding to the value of interest. If you do not want to select any of the values, enter **EXIT** to return to the entry form. Valids for some criteria (discipline and parameter keywords, and discipline and location keywords) are cross-validated so that only combinations for which data set descriptions exist are displayed. When these criteria are combined with others such as sensor, source, or space and time coverage,

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however, the use of valid lists does not guarantee that data set descriptions matching the search criteria will be found in the MD.

ENTER "SEARCH" TO SELECT DATA SETS

Once you are satisfied with the criteria entered, move to the command line (either using carriage returns or a period) and enter **SEARCH** to retrieve data set information.

Multiple Keyword Form

If you choose to search using the multiple keyword option, you can enter up to four keywords of any type (e.g., sensor names, geophysical parameters, discipline keywords, spacecraft names). THERE ARE NO VALID LISTS AVAILABLE FROM THE MULTIPLE KEYWORD ENTRY FORM. The multiple word search defaults to searching for data sets with *any* of the keywords entered (a Boolean OR, e.g., **Wind OR Nimbus OR Ocean**). You can change the **OR** value to an **AND** if you want to search for data sets containing a specific combination of keywords (e.g., **Temperature AND Cloud AND Aerosols**).

Once you are satisfied with the criteria entered, move to the command line (either using carriage returns or a period) and enter **SEARCH** to retrieve data set information.

ENTER "SEARCH" TO SELECT DATA SETS

The system will search the data base for data set descriptions as soon as the search command is entered. A list of data set titles that match the keywords and/or criteria specified will be displayed. The total number of titles found will be displayed at the top of the screen. You can page through the titles by entering **NEXT** (or carriage returns); the current page and total number of pages will be displayed in the upper right-hand corner.

SELECT A TITLE OF INTEREST

After looking at the titles, enter the number that corresponds to a data set of interest. To modify your search, enter **EXIT** to return to the previous level.

PRESS RETURN TO PAGE THROUGH THE INFORMATION OR ENTER DISPLAY FOR A MENU OF AVAILABLE DISPLAY SCREENS

After you select a title of interest, a brief description of the data set will be displayed. You can continue to enter carriage returns to page through the data set information. Available information is displayed in the following sections:

Brief Description
Data Set Attributes (keywords, coverage, spacecraft)
Archive Information
Data Set Personnel
Bibliographic References

You can use the **DISPLAY** command to display any of these sections or to see a menu of available screen display options. In some cases you can use the **SUPPLEMENT** command to display related data center or project information.

If the **LINK** command is displayed at the end of the command line, you can enter **LINK** to connect to the discipline directory, catalog, or inventory system to find out more information about the data set. When you log out of a remote system, you will be returned to the same screen from which you entered the **LINK** command.

To select a new title, enter **EXIT** or **D Q** (for **DISPLAY QUERY_RESULTS**).

4. SEARCHING FOR DATA CENTER/DATA SYSTEM DESCRIPTIONS

After you select the data center search option from the MD main menu, an entry form will be displayed. Enter the common name (acronym) for the data center or data information system of interest (e.g., NSSDC, NODS, PDS, PLDS). For a list of available descriptions, enter ? and then enter the number that corresponds to your choice.

After entering the data center or data system name, enter **SEARCH** to search for the information. Then select the desired option from the query results and page through the available information. Enter **DISPLAY** to view the available screen display options.

5. SEARCHING FOR CAMPAIGN/PROJECT DESCRIPTIONS

After you select the project information search option from the MD main menu, an entry form will be displayed. Enter the common name (acronym) for the scientific project of interest (e.g., ISCCP, FIFE). For a list of available project names, enter ? and then enter the number that corresponds to the project of choice.

After entering the project name, enter **SEARCH** to search for the project information. Then select the desired option from the query results and page through the available information. Enter **DISPLAY** to view the available display options.

6. EXIT THE MD

ENTER "QUIT_MD" WHEN YOU WANT TO LEAVE THE MD SYSTEM

After being prompted for any comments, you will be returned to the NSSDC menu. You can then select the logout option from the NSSDC main menu.

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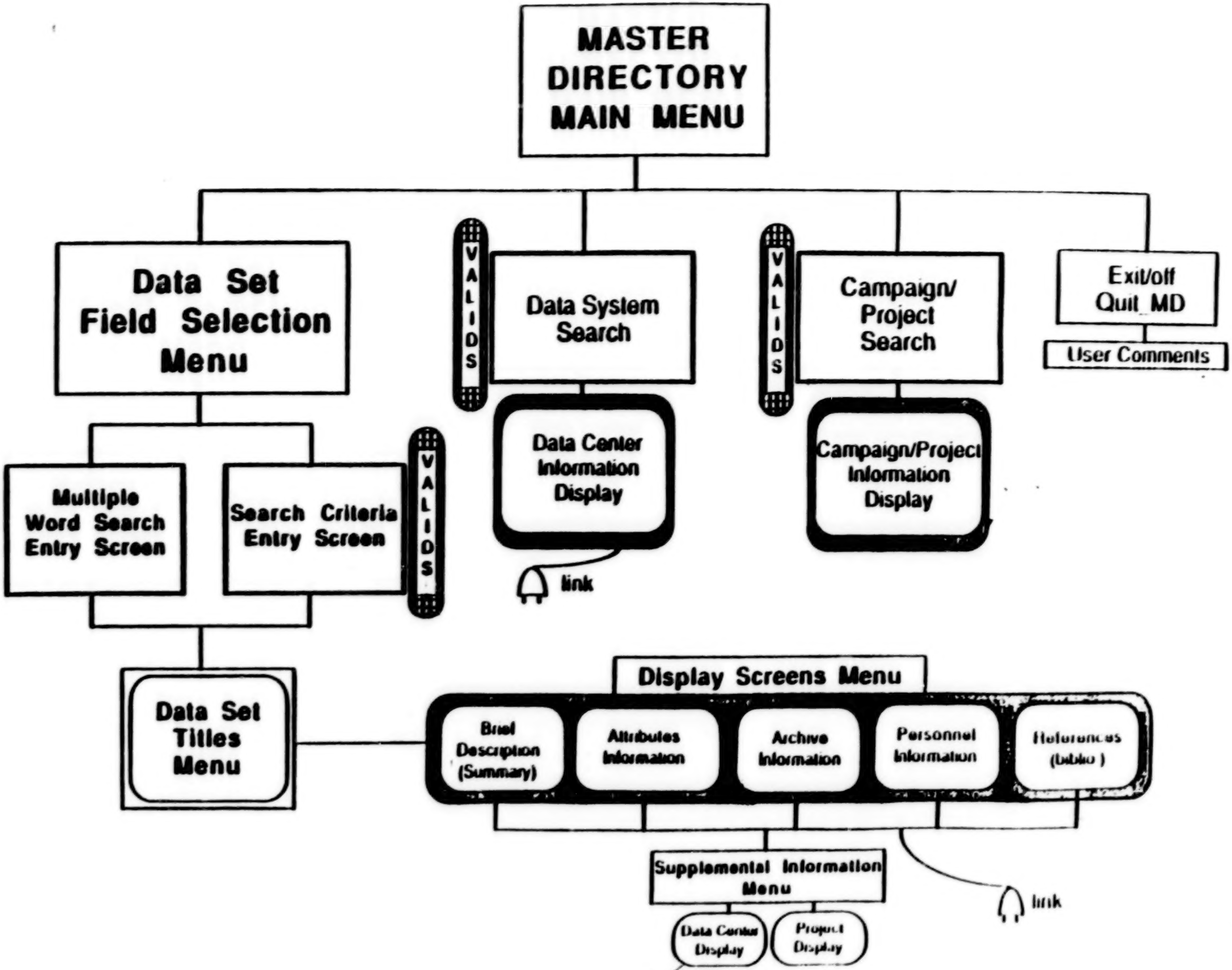
MASTER DIRECTORY MAIN MENU
Data Set Field Selection Menu
VALIDS
Data System Search
VALIDS
Campaign/ Project Search
Exit/off Quit_MD
User Comments
Multiple Word Search Entry Screen
Search Criteria Entry Screen
VALIDS
Data Center Information Display
link
Campaign/Project Information Display
Data Set Titles Menu
Display Screens Menu
Brief Description (Summary)
Attributes Information
Archive Information
Personnel Information
References (biblio.)
Supplemental Information Menu
link
Data Center Display
Project Display

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B. Pilot Land Data System

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Access through Telenet:

Telenet's asynchronous dial-in services are available to PLDS users across the USA with either a local call or an IN-WATTS call (1-800-255-NASA). To use this service you must have a valid NASA Packet Switch Network (NPSS) userID & Password. Call your local PLDS user support office (see back) and they will file the paperwork to get your valid userID and Password. It will take about 3 weeks for Marshall Space Flight Center to process the request and issue your userID. When you get your ID the PLDS USO will explain how to access PLDS via Telenet.

Access through NASA Science Internet:

TCP/IP:

If your terminal has access to the TCP/IP protocol, you can connect to the PLDS computers. Many national networks are interconnected. NSI is connected to a wide variety of TCP/IP networks such as NSFnet and is referred to collectively as the *Internet*.

At the prompt ($ or %) on each node, enter **telnet** and the name of the node given below. If the HOST UNKNOWN message appears, at the prompt, try again using the number instead of the node name. At the USERNAME: or login: prompt, log on with **plds** or your assigned user account name.

DECnet:

Users with access to NSI DECnet, formerly the NASA Space Physics Analysis Network (SPAN), can connect as follows: At the $ prompt, on VMS systems, enter **SET HOST** and the name of the PLDS node from the table below. If that fails try again using the DECnet number given in the table.

[illegible]	TCP / IP		DECnet	
	[illegible]	[illegible]	[illegible]	[illegible]
ARC	pldsa1.arc.nasa.gov	128.102.24.24	pldsa1	[illegible]
GSFC	pldsg3.gsfc.nasa.gov	128.183.104.8	pldsg3	[illegible]
JPL	pldsj2.jpl.nasa.gov	128.149.1.148	pldsj2	5542

Ordering/Price Policy

Use of PLDS and data ordered from PLDS is free of charge to authorized scientists. Contact a PLDS user support office for authorization (see back). Scientists may request that data be sent to them on magnetic media, over the networks to their local computer, or to their disk space on a PLDS computer. Written format documents are sent upon request with all orders for digital data.

User Support Office		
PLDS User Support Office NASA Goddard Space Flight Ctr Code 934 Greenbelt, MD 20771	(301) 286 9761 FTS 888 9761	PLDSG3::PLDSUSO SUPPORT/GSFCMAIL pldsuso@pldsg3.gsfc.nasa.gov
PLDS User Support Office NASA Jet Propulsion Laboratory Mail Stop 183-501 Pasadena, CA 91109	(818) 354 6363 FTS 792 6363	PLDSJ1::GEORGE george@pldsj2.jpl.nasa.gov
PLDS User Support Office NASA Ames Research Center Ecosystem Sci & Tech Branch Mail Stop 242-4 Moffett Field, CA 94035	(415) 604 5947 FTS 464 5947	ECO::PLDS GLANGELICI/NASAMAIL gary@pldsa1.arc.nasa.gov

Hours

pldsg3, NASA Goddard Space Flight Center
USO: 9:00 AM - 5:00 PM, Monday through Friday
Computer: 24 Hours, Monday through Sunday
Computer Operator: 24 Hours, Sunday through Friday

pldsj2, NASA Jet Propulsion Laboratory
USO: 9:00 AM - 4:00 PM, Monday through Friday
Computer: 24 Hours, Monday through Sunday
Computer Operator: 7:30 AM - 3:00 PM (Pacific Time), Monday through Friday

pldsa1, NASA Ames Research Center
USO: 8:00 AM - 4:30 PM, MOnday through Friday
Computer: 24 Hours (Pacific Time), Monday through Sunday
except 9:00 - 11:00 AM Monday

PLDS Project Office
Code 934, Goddard Space Flight Center
Greenbelt, Maryland 20771

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A GUIDE TO NASA's PILOT LAND DATA SYSTEM (PLDS)

January 1991

NASA

National Aeronautics and
Space Administration

Description

NASA's Pilot Land Data System (PLDS) is a distributed information management system designed to support NASA's land science community. The PLDS provides a wide range of services including management of information about scientific data, access to a library of scientific data, a data ordering capability, communications, connection to data analysis facilities, and electronic mail. The PLDS provides these services by offering scientists the capability to search for and order data, and to communicate electronically with other scientists and computers. Three functions enable scientists to find what data are available and where they reside. The first two, *Find data summaries* and *Read detailed descriptions* give summary and detailed descriptions about data sets or groups of related data sets, science projects, and institutions which archive land data. The third, gives information about specific pieces of data. This last function has two components, *Search systemwide inventory* and *Search local inventory*. The first component enables the user to find data elements (images, geological samples, transects, maps, etc.) that exist anywhere in the PLDS while the second has only information about data at the local site. The first enables the user to find pieces of data from several different data sets with the same temporal and spatial coverage and other elements common to most data sets, while the second allows the user to select a data set based on these descriptors and on those that are unique to a data set.

The PLDS provides capabilities that enable electronic file transfers, intercomputer connection, and electronic mail. Both TCP/IP and DECnet protocols are supported via the NASA Science Internet (NSI). Access is also available through Telenet.

To acquire data, users can place orders through the PLDS while logged on or they can call one of the User Support Offices listed on the back.

The scientific data and related descriptive information managed by PLDS come from several sources. These include four NASA land science projects (First ISLSCP Field Experiment (FIFE), the Inter-Disciplinary Sciences-Land Surface Climatology (IDS-LSC) project, the Sedimentary Basins Project (SBP), and the Oregon Transect Ecosystem Research Project (OTTER)), and several other data processing facilities, individual scientists and data systems.

All information about specific pieces of scientific data has passed a check for internal consistency and typographical errors. In addition, information about the validity of the scientific data is also provided if it was supplied with the data.

Contents

Data set	Site Location
Aerial Photos (VIS, IR)	ARC
Airborne Sun Photometer	ARC
Aircraft SAR	JPL
AIS (Airborne Imaging Spectrometer)	JPL (Future)
Auto Meteorological Station	GSFC
AVHRR (LAC)	GSFC
AVIRIS	JPL (Future)
Daedalus (Thematic Mapper Simulator)	ARC
Digital Elevation Models	JPL
Field Spectra (PIDAS, PFES)	JPL (Future)
Geological Samples	JPL (Future)
MSS	GSFC (Future)
NS-001 (Thematic Mapper Simulator)	ARC, GSFC
Polarization Differences Vegetation Index (PDVI)	GSFC
Snow Cover	GSFC
Spectra (FTIR, Beckman)	JPL (Future)
TIMS	ARC, GSFC, JPL
TM	GSFC

Access Procedures

There are three PLDS sites, one at the Ames Research Center in California, one at the Goddard Space Flight Center in Maryland, and another at the Jet Propulsion Laboratory in California. Scientists wishing to use the PLDS must have an account on a PLDS computer. To obtain an account you must be an authorized user. For details contact a PLDS user support office (see back). A PLDS demonstration account (an account with limited privileges) is available at all PLDS sites, username **plds**. This account is for the infrequent user or the curious. Users wishing to place orders for data must have a personal account or be an authorized user. There are several ways to access the PLDS: Dial-in modems; Telenet; and NSI (TCP/IP or DECnet).

Dial-in modems:

Users can connect to PLDS through dial-in modems. 300, 1200, and 2400 baud rates are supported by the data system.

Setting	Preferred Value (optional value in [ ])
Mode	ANSI
Parity	Even [Disabled]
Bits per character	7 [8 when parity disabled]
Baud	Equipment dependent either 300 or 1200 [2400 is connection specific]
Protocol	X On/X Off
Duplex	Full duplex preferred; Equipment dependent

Dial-in phone numbers:

Site	FTS	Commercial
ARC Site	464-7779	(415) 604-7779
GSFC Site	888-9000	(301) 286-9000
JPL Site	977-6324	(818) 393-6324

After dialing a site follow the steps given below for that site.

ARC: At the login: prompt, type **plds** or your user account name. If the login prompt does not appear press the **BREAK** key until you get the prompt.

GSFC: Press the return key until the ENTER NUMBER: prompt appears. Enter **PLDS** and press the **RETURN** key. At the CALL COMPLETE: prompt, press the **RETURN** key. At the USERNAME: prompt, logon with **PLDS** or your user account name.

JPL: At the login: prompt, type **plds** or your user account name.

C. COSMIC

COSMIC

Software Catalog
1991 Edition
Diskette Format

This Catalog may be copied and shared

COSMIC
The University of Georgia
382 East Broad Street
Athens, GA 30602
Phone: (404) 542-3265
Fax: (404) 542-4807
E-Mail: COSMIC@UGA. (bitnet)
SERVICE@COSSACK.COSMIC.UGA.EDU (internet)

I. Introduction

This PC edition of the annual COSMIC Software Catalog contains descriptions of the over 1,200 computer programs available for use within the United States as of January 1, 1991. By using the PC version of the catalog, it is possible to conduct extensive searches of the software inventory for programs that meet specific criteria. Elements such as program keywords, hardware specifications, source code languages, and title acronyms can be used for the basis of such searches.

After isolating those programs that might be of interest to the user, it is then possible to either view at the monitor, or generate a hardcopy listing of all information on those packages. In addition to the program elements that the user can search on, information such as total program size, distribution media, and program price, as well as extensive abstracts on the programs, are also available to the user at this time.

Another useful feature of the catalog allows for the retention of programs that meet certain search criteria between individual sessions of using the catalog. This allows users to save the information on those programs that are of interest to them in possibly different areas of application. They can then recall a specific collection of programs for information retrieval or further search reduction if desired. In addition, this version of the catalog is adaptable to a network/shared resource environment, allowing multiple users access to a single copy of the catalog database simultaneously.

The enclosed disk contains all of the files and application programs necessary to install the COSMIC Software Catalog on a hard disk drive and/or a networked NETBIOS based environment.

II.Catalog Installation Instructions

Before installing the catalog software and data, it is suggested that the user backup the distribution disk with the DOS "diskcopy" command. In order to properly install the COSMIC Software Catalog, approximately 4.5 Mbytes of disk space is required. This provides for sufficient space to hold all information on COSMIC's entire inventory as well as the software to access the data. However, this space can either be located on a local hard disk, or a network (shared access) drive.

The user first must create a directory that will hold all the necessary files for the COSMIC Catalog. It is suggested that the directory be called "COSMIC" although it is not required.

```
example:  C> md COSMIC
```

After creating the directory (hereafter referred to as COSMIC) the user then moves to that directory via the DOS "cd" command.

```
example:  C> cd \COSMIC
```

Note that this directory may be located either on the user's local hard disk or on a shared resource networked drive.

The user then places the working copy of the COSMIC Catalog diskette into the appropriate local high density floppy disk drive. Nex, the user must make that floppy drive the current or logged drive.

```
example: C> A:
```

We now will use PKWARE's PKUNZIP utility (included on the catalog distribution disk) to install the data and program files in the desired directory. This is done by typing PKUNZIP, CATALOG (the name of the ZIP file containing the program and data files) and the name of the destination drive ('C:' in our example):

```
A> pkunzip catalog c:
```

PKUNZIP will then display the names of the files as they are extracted from CATALOG.ZIP and placed in the default directory on the specified destination drive ('C:\COSMIC' in our example).

In order to conserve space on the distribution disk, several index files have been left off and must be generated before the program will function properly. The user must now make the destination drive and directory the current working directory ('C:\COSMIC' in our example) by logging on to the drive specified in the PKUNZIP command line above:

```
A> C:
```

We will now invoke the catalog program, COSMICAT, with a special command line option to generate the index files:

```
C> cosmicat reindex
```

The program will notify you that it is creating the index files and will return you to the DOS prompt when it is finished. You may now remove the working copy of the catalog diskette and return it to a safe place or give it to a friend. If you encounter problems with any of the steps above, please feel free to call COSMIC at (404) 542-3265 and we will help you resolve the situation.

To complete the installation process, the user (or system administrator) must decide if the catalog will be used in a shared environment or not. If the catalog is to be used solely by an individual on his or her own system, no other installation procedures are necessary, simply jump to section III on usage.

If, however, the catalog is to be used in a network environment, some additional steps are necessary. First, the shared access location of the catalog must be determined. It is in this shared location that multiple users can simultaneously access the database files (.DBT & .DBF) + index files (.NTX) mentioned above, with optional shared access to COSMICAT.EXE. This location (shared drive name + pathname) must be typed in a single line ASCII text file called PATHNAME.TXT. It is also important to have this path name end in a backslash ("\") character within the PATHNAME.TXT file for proper file name construction. PATHNAME.TXT will then be placed in the personal execution directory of all individuals who will be accessing the catalog. This personal execution directory is very important in using the catalog in a shared environment since the COSMIC Catalog creates temporary and semi-temporary files during the course of its execution.

The personal execution directory should be located on the local hard disk (could also be a floppy, but that's very slow) of the individual and should contain the following:

1) The file PATHNAME.TXT containing the shared resource location of the catalog data files (all .DBT, .DBF & .NTX files). Note that this file can be created with any ASCII text editor.

and

2) Either the executable portion of the catalog, COSMICAT.EXE or a batchfile which, when run, executes a shared version of COSMICAT.EXE through explicit pathname invocation.

In either case, the current working directory during execution of the catalog must remain in the personal execution directory.

For example, let us assume that the catalog databases, indexes, and the COSMICAT.EXE file have been placed in directory COSMIC on the shared network drive N:. Additionally, we'll assume that each user has created a personal directory named COSMIC on his/her local C: drive. Each user would then place an ASCII text file named PATHNAME.TXT in their C:\COSMIC directory containing the single line:

```
N:\COSMIC\
```

For convenience sake, one might create a batch file in a directory that is referenced by the DOS PATH environmental variable (usually a directory called something like DOS, UTILS, or BATS) named COSMICAT.BAT. This file might be created as follows:

```
C>copy con: c:\bats\cosmicat.bat
ECHO OFF
CLS
ECHO One moment, invoking COSMIC catalog...
C:
CD\COSMIC
N:\COSMIC\COSMICAT
```

(To terminate this input and return to the DOS prompt, type Ctrl-Z, and press the Enter key.)

For any questions on the installation process, feel free to call COSMIC at (404) 542 - 3265.

III. Catalog Usage Instructions

To begin a catalog session the user first must move to the directory containing the file COSMICAT.EXE (and the file PATHNAME.TXT if the database is to be located on a networked drive). To start the application, type "cosmicat" at the DOS prompt (C>). The application will then generate two successive screens with information on COSMIC as well as the address and phone number of COSMIC if further assistance is necessary. Pressing any key will move the user through these screens to the Main Menu.

After the two introductory screens, the Main Menu screen is displayed. At this point, four different activities are possible:

The user can either: 1) Generate a screen or hardcopy listing of all possible keywords that are used in the Catalog; 2) Begin searching the inventory for programs meeting user provided search criteria; 3) Generate a screen or hardcopy listing of all information on a particular program or programs; or 4) Exit the COSMIC Software Catalog and return to DOS. Pressing the appropriate key will then activate the activity desired. The following is a brief discussion of each activity.

A) List All Possible Keywords

All programs in the COSMIC inventory have been assigned an average of five different keywords selected from the NASA Thesaurus (NASA SP-7064). By selecting this option, the user is provided a mechanism to list all unique keywords employed in the current catalog. This is useful in deciding upon search criteria for use in later inventory searches. When this option is selected, the user is prompted to choose either the printer (PRN:) or the screen as the output device.

If the user selects the screen, an alphabetic listing of all keywords is sent to the monitor, one screen at a time. The user can then either successively view the proceeding screens (by pressing "m"), or terminate the current listing and return to the Main Menu (by typing "x"). If, however, the user chooses the printer as the output device, a continuous alphabetic listing of all keywords is sent to the printer immediately. This listing is rather lengthy — printing in a vertically compressed mode will help save paper. As soon as the listing is complete, the user is returned to the Main Menu.

B) Perform a Search on Inventory

By performing successive searches on the COSMIC software inventory, the user is provided a powerful mechanism for isolating those software packages that directly apply to the user's area of interest. Presently, searches can be done on four different information fields included with each program. When the Search Menu is first selected one of two possible situations will occur. Either the user will be prompted to select the field on which to search the entire inventory, or, if a past search produced a subset of programs (retained in a file called HOLDSAVE.DBF located in the current working directory), the user will be asked to choose which group to search on (the entire inventory or HOLDSAVE.DBF). If the user chooses to use the entire inventory as the search base, the present HOLDSAVE.DBF file will be discarded (ie. deleted) in favor of generating a new subset file from the upcoming search. This gives the user the ability to manually (ie. through appropriate DOS commands) save the current HOLDSAVE.DBF file under a different file name (the HSFSN.NTX index file must also be saved in this instance as well) in order that the results contained in HOLDSAVE.DBF can be retained for future reference. By simply renaming the files back to HOLDSAVE.DBF and HSFSN.NTX within the COSMIC Catalog directory at some future time, the user can again recall these past results when using the catalog.

The fields on which a search can take place:
1) Titles & Acronyms; 2) Keywords; 3) Host Computer Types; and 4) Source Code Language. In addition, the user is given the option of returning to the Main Menu. All four search possibilities will prompt the user for a string of characters (NOT case sensitive) which will then be compared to the corresponding field of all programs in the inventory (or a subset thereof). It should be noted that all searches look for the string provided by the user to occur anywhere within the field being searched. This allows for context searching of strings within fields.

After typing a carriage return to terminate the search string (or <ESC> to cancel the present search), the text "....searching...." appears on the screen. The amount of time needed to search varies depending upon processor speed, as well as the search base being employed (entire inventory or HOLDSAVE.DBF subset). If the entire inventory was used for the search, the user is then prompted with the string "...One Moment Please..." while some file maintenance activities take place.

As soon as these activities are completed (again time may vary with processor speed), one of four possible windows will appear. If NO programs were found satisfying the previous search condition and the entire inventory was being used as a search base, the user will be prompted as such and will then be returned to the Main Menu. If the subset file HOLDSAVE.DBF was being searched and no programs were found, the user will be prompted as such with the current number of programs held in HOLDSAVE.DBF displayed as well. Since no programs were found, the HOLDSAVE.DBF subset file used as the previous search base will be retained for any future searches. Again, in this situation, the user is returned to the Main Menu.

When programs are found satisfying the search condition, a window appears displaying the current number found in the upper right hand corner. If the entire inventory was used as the search base, the user is then given three options: 1) listing the program call-numbers and partial titles of all currently found programs to the monitor (one screen at a time, if necessary); 2) listing the same information to the printer; or 3) immediately returning to the Main Menu. Regardless of the option chosen, those programs found will automatically be retained in the subset file, HOLDSAVE.DBF, for later searching and reduction.

If, however, the search was performed on the HOLDSAVE.DBF subset file, the user is prompted with a window displaying the current number of programs found, as well as the number of programs that were being held in HOLDSAVE.DBF prior to the search. The user is then given the option of replacing the HOLDSAVE.DBF file with the newly found subset of programs for future searches; discarding the results of the last search in favor of retaining the search base just used (HOLDSAVE.DBF); or rejecting both the current results and the previous HOLDSAVE.DBF search base in favor of using the entire inventory for future searches. In all three cases, the user is immediately returned to the Main Menu after choosing an appropriate response. To further reduce the current HOLDSAVE.DBF, the user would again choose the Search option of the Main Menu.

C) Output Results

A most important aspect of any catalog is the way in which information on particular items is presented. The COSMIC Software Catalog for microcomputers has the ability to either browse information on particular programs at the screen, or generate a hard-copy listing on the local printer. In addition, the user can manually enter the call numbers of the item to be displayed, or use the programs held in HOLDSAVE.DBF as input into the listing routines.

When Output option is chosen from the Main Menu and there is currently NO HOLDSAVE.DBF in existence, the user is prompted to manually enter the call-numbers of the program to be displayed. The call-numbers consist of a three letter, 5 digit sequence of characters separated by a hyphen (-). The user can either type in the call number (followed by a carriage return <CR>) or simply press the <CR> to return to the Main Menu.

If the call-number provided does NOT match any in the current COSMIC inventory, the user will be informed of this fact and returned to the call-number entry window. Otherwise, the user is then prompted for the device for output purposes: the monitor screen or the local printer. Choosing the local printer will send a complete listing of all information on the selected program to the PRN: device. This includes program size, distribution media, and program price, as well as a complete abstract on the program itself. If, however, the user selects the monitor as the output device, the entire screen will be filled with all information on the program. In addition, the user will be able to scroll through the program abstract window using the <UpArrow>, <DownArrow>, <PgUp>, and <PgDown> keys. To finish browsing the abstract, simply press the escape key (<Esc>). You will then be returned to the manual call-number entry screen.

If, however, a HOLDSAVE.DBF file exists, the user is given the option of either manually entering program call numbers to browse (described above), or using the call numbers that have been saved in the current HOLDSAVE.DBF subset file. By selecting the option of using HOLDSAVE.DBF for browsing, the user is displayed successive program call numbers to act upon. For each call number presented on the screen, the user may either display the program information at the terminal, generate a hard copy listing of the program information at the local printer, skip the particular program in question in favor of working with the next sequential program call number held in HOLDSAVE.DBF, or exit the output activity entirely and return to the Main Menu.

Note that the programs stored in HOLDSAVE.DBF will not be affected by returning to the Main Menu.

D) Exiting The COSMIC Software Catalog

Selecting this option cleans up all files and screen modes and returns the user to DOS. It should be noted here that if there was a HOLDSAVE.DBF file generated or retained during the current catalog session, it and its companion index file, HSFSN.NTX will be retained in the current working directory and can be used during the next execution of the catalog software.

If you have any suggestions on how to improve the catalog in future releases or have questions concerning the operation of this package, feel free to contact COSMIC.

D. TGV, Inc.

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SOFTWARE
PRODUCT
DESCRIPTION

TGV

Product Name **MultiNet**, Version V2.2

Overview

MultiNet™ is a high-performance VAX/VMS multi-protocol networking environment currently supporting the TCP/IP family of protocols, the Xerox PUP protocol, and the CHAOSnet protocol. ***MultiNet*** supports the entire family of TCP/IP services and devices. An ***NFS Client*** and an ***NFS Server*** are available as options. ***MultiNet*** includes all of the tools you need for any configuration, from an end-node system with a single Ethernet interface to a fully functional gateway with multiple interfaces and routing protocols.

MultiNet uses state-of-the-art networking technology, utilizing the 4.3BSD TCP networking code running in the VAX/VMS kernel environment. ***MultiNet*** communicates directly with user processes via a $QIO interface, and directly with VMS device drivers at the kernel level. ***MultiNet's*** kernel-implementation of lightweight process threads delivers maximum application-to-application performance.

MultiNet installs quickly, using the VAX/VMS VMSINSTAL utility. ***MultiNet's*** configuration utilities get you on the air quickly and painlessly. For example, the ***MultiNet*** Network Configuration Utility interactively customizes ***MultiNet*** to your network environment and then generates all configuration files and the startup command procedure. The ***MultiNet*** SET and SHOW utilities allow a system manager to examine the state of the network, and examine and modify the ***MultiNet*** configuration without rebooting.

VMS users and system managers adapt quickly to the ***MultiNet*** environment and its services. All ***MultiNet*** applications and configuration management utilities include VMS-style interfaces with DCL commands, VMS HELP library entries, and clear, logical prompts. Additionally, ***MultiNet*** includes DECwindows support, providing users the ability to run DECwindows applications over TCP/IP in addition to DECnet.

Supported Configurations

MultiNet supports DIGITAL's VAX and MicroVAX computers in any valid VMS configuration. ***MultiNet*** runs under VMS versions from V4.5 and upward, and uses spinlock synchronization to support Symmetrical Multi-Processing (SMP) under VMS V5.

Supported Devices

Typically ***MultiNet*** is used with the DEC-supplied Ethernet controller provided with your VAX hardware. ***MultiNet*** supports all DEC Ethernet controllers using a standard kernel-level interface into any VAX/ VMS Ethernet driver. Using the driver's multiplexing features, ***MultiNet*** can share the controller with other protocols; for example, DECnet, LAT, and Local Area VAXclustering. Up to ten such Ethernet controllers per machine are supported.

MultiNet also supports the following network devices:

- ACC's LH-DH ARPAnet controller
- ACC's ACP-5100 and ACP-6100 HDLC T1 controllers
- ACC's ACP-5250 and ACP-6250 X.25 controllers
  The ACP-5250 and ACP-6250 may be used to connect to the Defense Data Network PSNs
- CMC's ENP family of Ethernet controllers
- Symbolics' CHAOSnet 4-Megabit controller
- IMP11-A ARPAnet controller

- DEC's DMR-11, DMC-11, and DMV-11 DDCMP controllers
- 3-Com's Ethernet controller
- Xerox's 3-Megabit Ethernet controller
- Excelan's EXOS UNIBUS and Q-bus controllers
- NSC's PI13/14 Hyperchannel controller
- Interlan's NI1010 Ethernet controller
- SLIP (Serial Line IP) using any VMS supported terminal multiplexer
- Proteon's proNET-10 and proNET-80 Token-Ring controllers

In addition, when ***MultiNet*** is configured to use more than one network device, it can serve as an IP gateway between those devices.

SERVICES

All inbound network connections are handled by the ***MultiNet*** Master Server process. This process is responsible for accepting or rejecting a connection, and for either performing or invoking the requested service. Using the Server Configuration Utility, the system manager can enable, disable, and add new services to the Master Server's configuration. The system manager can also have the Master Server restrict IP host and network access on a per-service basis. The Master Server can keep an audit trail of attempted, accepted, and rejected connections, which can be enabled on a per-service basis. The Master Server can log the times, source addresses and names, and the services requested.

MultiNet supports each of the following standard protocols. Unless otherwise stated, both client and server forms are supplied.

DOMAIN NAME SERVICE (RFC1034, RFC1035, RFC1101)

MultiNet provides Domain Name Service using Berkeley's BIND 4.8.1 nameserver running internal to the Master Server. No separate process slot is required, eliminating some scheduling overhead. BIND can function either as a caching-only nameserver to assist the resolver, or as a fully functional primary and secondary nameserver that advertises information about the hosts on your network. Domain Name Service under ***MultiNet*** also supports encoding of network names and numbers according to RFC1101. The NSLOOKUP utility is provided to assist in tracking and degugging Domain Name System configuration problems. All user utilities translate names to internet addresses using Domain Name Service.

MultiNet also supports the standard RFC952-format host tables, offering exceptionally rapid access. Instead of directly accessing the ASCII host table file, ***MultiNet*** compiles it, using a perfect-hashing scheme, and installs it in a global section. The host table scheme can be used in conjunction with Domain Name Service, allowing failed Domain Name System queries to be converted to host table lookups before being returned to the user.

TELNET (RFC854, RFC855, RFC856, RFC857, RFC1041, RFC1073, RFC1079, RFC1080, RFC1091)

MultiNet's TELNET virtual terminal utility provides login access between your machine and any other node on the IP network. Access through the network is quite transparent because the TERMINAL TYPE, WINDOW SIZE, DYNAMIC FLOW CONTROL, and BAUD RATE options are supported and negotiated automatically. ***MultiNet's*** TELNET client also supports the TN3270 protocol allowing VMS users to access IBM mainframes as a 3270 block mode terminal. The TELNET server directly connects the TCP network kernel to the VMS terminal class driver, providing efficiency on par with LAT or directly-connected devices. As there is no limit on the number of incoming TELNET sessions, and only about 500 bytes of memory are required per connection, ***MultiNet*** is ideally suited for terminal-server applications with hundreds of incoming sessions per machine.

DECwindows

MultiNet's DECwindows support provides users the ability to run DECwindows and X windows applications over TCP/IP in addition to DECnet. This support allows users to run applications between VMS systems and non-DEC computer systems that support X windows over TCP/IP. ***MultiNet*** supports DECwindows by providing a $QIO interface that emulates DEC's VMS/ULTRIX Connection (UCX) product, effectively making DECwindows think it's running over UCX.

FTP (RFC959)

The File Transfer Protocol (FTP) utility provides high-speed reliable transportation of files. ***MultiNet's*** FTP includes two noteworthy extensions to the standard FTP protocol. A special mode pro-vides transparent and efficient transportation of any FILES-11 file (e.g., ISAM-indexed files) between any two VMS machines. Another extension provides on the fly Lempel-Ziv (L-Z) compression between the client and server to minimize network traffic, at the expense of additional host overhead. L-Z compression effectively increases the bandwidth of slow lines by 30-100% (typically 60-70%).

The FTP Server uses the standard VMS LOGINOUT utility for account validation and setup, thus fully supporting all related VMS security features such as ACLs, accounting, auditing, and break-in detection and evasion.

SMTP (RFC821, RFC822, RFC974)

MultiNet includes a Simple Mail Transfer Protocol (SMTP) mail system which interfaces to the VMS MAIL utility or the MM mail user interface, allowing VMS users to send and receive SMTP mail transparently. Outgoing mail is submitted to a VMS queue, where the Mail Symbiont immediately attempts delivery, and in the event of a network failure, requeues the mail for later delivery. When using VMS MAIL, all standard features are supported, including SET FORWARD and address aliasing. The ***MultiNet*** SMTP mail system itself supports an easy-to-configure address alias and mailing list database.

MM

The MM utility provides an alternative to VMS MAIL for electronic mail users. MM offers several useful features not available under VMS MAIL, including: the ability to save and restore messages before sending them; the ability to create user-defined headers; and a sophisticated message filing and manipulation scheme. MM can be used to send both SMTP and DECnet mail. Additionally, the MM utility can be used to send mail via the PMDF electronic mail gateway system available from Innosoft International, Inc.

RPC and NFS (RFC1057, RFC1094)

MultiNet includes the Sun Microsystems developed public-domain remote procedure call (RPC) library to allow users to develop their own RPC-based applications. ***MultiNet*** also includes the RPC Port Mapper and the RUSERS (display users logged-in to remote systems) and RWALL (broadcast a message to all users on remote systems) services.

The optional ***MultiNet NFS Client*** allows VMS applications to transparently access files stored on NFS servers. The ***NFS Client*** can remote mount file systems on ANY system having an NFS server. The ***NFS Client*** device driver provides a standard file system interface and is called automatically by the normal VMS Record Management Services (RMS). Remote NFS servers supporting full UNIX (NFS) file system semantics appear to VAX/VMS systems as fully-functional Files-11 ODS-2 file systems. This includes support for multiple file versions and arbitrary VMS (RMS) file attributes. Files created on the server system appear as Stream_LF files to the local VAX/VMS system; text files created by the local VAX/VMS system appear as normal "Stream" files on the server; and other VAX/VMS file types are stored on the NFS server as "raw" VMS data blocks. This permits other VAX/VMS clients to share these files on the NFS server and non-VMS systems to access the data, provided the non-VMS systems are capable of interpreting the "raw" VMS data blocks.

The optional ***MultiNet NFS Server*** is a high-performance server implementation of the Network File System (NFS) standard developed by Sun Microsystems. The ***NFS Server*** maps the complete UNIX file system semantics onto the VMS file system, including symbolic and hard links and device files, making a VMS file system look exactly like a UNIX file system. All VMS text files are type-converted to look like UNIX stream files for maximum interoperability. The ***NFS Server*** uses a file and directory cache between the file system and the network, to mask VMS bottlenecks from the requesting UNIX machine. The ***NFS Server*** runs in the kernel and uses a proprietary XDR serializer to move data directly between the file system cache and the net-work buffers. By default, the cache functions as a write-through cache, but it can be configured as a write-back cache to increase performance. The ***NFS Server*** can export all Files-11 ODS-2 VMS volumes, including shadow sets, bound volumes, and DFS-served disks. The ***NFS Server*** distribution also includes a PC-NFS authentication and print server (PCNFSD). It allows PCs and compatibles running PC-NFS client software to access NFS served filesystems as though they are local DOS disk drives. PCNFSD supports printing from PC clients to VMS print queues.

REMOTE PRINTER SERVICES

An LPD client and server allow ***MultiNet*** users to access printers on remote UNIX computers, and allow the UNIX users to access printers connected to the ***MultiNet*** computer. The LPD server transparently makes VMS printer queues appear to remote UNIX users as local printers. The VMS system manager can use the Server Configuration Utility to grant or deny access to the VMS machine's printers.

The LPD client runs as a VMS Print Symbiont. VMS users use the native VMS PRINT command to print files transparently to remote UNIX machines. The system manager uses the Printer Configuration Utility to automatically configure, initialize, and start these special VMS printer queues.

UNIX "R" SERVICES

MultiNet includes the popular UNIX "R" services RSHELL, REXEC, RCP, RLOGIN, and RMT.

The RSHELL utility allows VMS users to remotely execute commands from the VMS command line, either by specifying a password, or by using access based on previously provided credentials. Likewise, the RSHELL and REXEC servers allow remote users to execute DCL commands directly from their command interpreters, a shell for UNIX users and DCL for VMS users.

MultiNet's RCP client and server allow users to copy files between systems on the network. ***MultiNet's*** RCP supports the recursive copying of directory trees between systems, and the transparent transfer of all VMS file types (e.g., ISAM-indexed files) between VMS systems running ***MultiNet***.

MultiNet's RLOGIN provides an alternative to the standard TELNET for remote virtual terminal access. RLOGIN is an ideal protocol for communication with UNIX machines. RLOGIN includes support for dynamic window sizing and dynamic flow control negotiation and will pass the terminal type and speed to the remote server. Like the ***MultiNet*** TELNET Server, the RLOGIN Server directly connects the VMS terminal driver to the network.

MultiNet's Remote Magtape Server (RMT) allows UNIX users to access your VMS tape drives via the network. The UNIX system manager can use the "rdump" and "rrestore" utilities to backup a UNIX system via the network to a VMS tape drive.

TALK

The ***MultiNet*** TALK utility is a VMS PHONE-like utility that allows users to communicate with users of other systems that support the TALK protocol. Like VMS PHONE, TALK provides a split-window screen, with one window displaying what one user types, and the second displaying what the respondent types. For maximum interoperability, both the 4.2BSD "Old Talk" and 4.3BSD "New Talk" protocols are provided.

Network Time Protocol (RFC1059)

MultiNet supports the Network Time Protocol (NTP). NTP provides a mechanism to synchronize and coordinate time distribution in large, diverse LAN or WAN environments. Once configured, NTP automatically polls other NTP clock servers and uses complex estimations of the network delay to determine the local time to accuracies approaching ten milliseconds. As clocks drift apart, NTP initiates a clock skew, running the VMS clock 10% faster or slower until the time drifts back into synchronization.

With a few WWVB-synchronized NTP servers on your network (such as the servers on the DARPA Internet), NTP can synchronize all of your VAX clocks.

FINGER (RFC742)

MultiNet's FINGER utility provides a status report about the users of a system. Because FINGER is supported in both client and server form, it can also supply status reports about the users of remote systems.

WHOIS (RFC954)

MultiNet's WHOIS client is provided to access the Internet's network-wide user directory service, which is maintained by the DDN Network Information Center (NIC) at SRI International, on behalf of the Defense Communications Agency (DCA). WHOIS can deliver the full name, U.S. mailing address, telephone number, and network mailbox for any DDN user registered in the NIC database.

NETSTAT

The ***MultiNet*** NETSTAT utility displays detailed information from a remote machine, including the current configuration and operation of the network.

SYSTAT (RFC866)

The ***MultiNet*** SYSTAT Server allows remote users to display the output of a VMS "SHOW SYSTEM" command.

BOOTP (RFC951, RFC1084)

MultiNet supports the BOOTP protocol, using V2.1 of BOOTP. BOOTP runs internal to the Master Server and quickly responds to booting diskless nodes requesting their boot parameters. BOOTP supplies the booting node with its Internet Address, Gateway, and other information it needs to configure and load.

RARP (RFC903)

MultiNet supports the Reverse Address Resolution Protocol (RARP) to provide booting diskless workstations their Internet (IP) addresses.

TFTP (RFC783)

MultiNet's Trivial File Transfer Protocol is provided in both client and server form. The TFTP server generally is used only for booting diskless workstations (because FTP provides a superior and more sophisticated file transfer protocol). TFTP's lack of authentication has traditionally posed a security problem for system managers needing to run TFTP. Since, however, the ***MultiNet*** Server Configuration Utility can be used to limit the machines which can access the TFTP server, and the ***MultiNet*** Network Configuration Utility can be used to limit access to a particular directory tree on the server, the ***MultiNet*** TFTP server can be used to provide boot services without threatening system security. The ***MultiNet*** TFTP client is an invaluable tool for debugging TFTP server problems.

SNMP (RFC1066, RFC1098)

MultiNet has support for a Simple Network Management Protocol (SNMP) agent, which answers queries for information such as interface status, protocol statistics, and routing information. SNMP runs internal to the Master Server and quickly responds to queries for information from SNMP management stations.

GATEWAY ROUTING PROTOCOLS

MultiNet provides support for the EGP (RFC911), RIP (RFC1058), and HELLO routing protocols using GATED Version 1.9. GATED runs internal to the Master Server process, and therefore does not occupy a separate VMS process slot. Through a configuration file, the system manager can configure GATED to dynamically discover all routing information, and subject to any administrative restrictions, choose the best route to each network. GATED is always watching for changing network conditions (such as a failing gateway), and when IP traffic must be rerouted, GATED directly manipulates the ***MultiNet*** routing tables to effect the change.

NETCONTROL

The NETCONTROL server runs internal to the Master Server and allows the VMS system manager to control other services that run internal to the Master Server. Normally NETCONTROL can be accessed only from the local node, but if the default restrictions in the Server Configuration Utility for this service are eased, access can be allowed from any machine on your network. The NETCONTROL client includes a DCL command interface that offers the system manager direct and simple control of the various services. For example, to reload the Domain Name Server database:

```
$ MULTINET NETCONTROL DOMAINNAME RELOAD
```

DIAGNOSTIC TOOLS

The ***MultiNet*** PING utility allows ***MultiNet*** users or the system manager to diagnose network problems by measuring the packet loss rate and delay to any node on your network. PING uses an ICMP ECHO request to bounce packets off of the target node.

The ***MultiNet*** TCPDUMP utility allows ***MultiNet*** to function as an Ethernet protocol analyzer to assist in debugging of network or protocol problems. TCPDUMP is only supported on DEC Ethernet controllers.

The ***MultiNet*** TRACEROUTE utility allows the ***MultiNet*** system manager to dynamically determine the current topology of the network to which he is connected. TRACEROUTE sends UDP packets with increasing Time-To-Live values, and examines the resulting ICMP TIME EXCEEDED returns to discover each intermediate gateway to the target node.

MultiNet includes TCP and UDP variants of the important diagnostic services CHARGEN, DAYTIME, DISCARD, ECHO, and TIME for debugging potential network problems.

CHAOSnet Services

MultiNet includes QFILE and RTAPE servers that give Lisp Machines access to the VMS file system and the VMS tape drives. A CHAOSnet TELNET client and server allow remote logins to Lisp machines that are not also running TCP/IP. NAME, TIME, and UPTIME servers are also provided.

PUP Services

In addition to PUP TELNET client and server for remote login, ***MultiNet*** provides the LEAF protocol remote file access and Gateway and Name lookup services.

Support for Non-DEC Terminals

All ***MultiNet*** utilities use the standard VMS SMG$ routines to access display terminals. Any non-DEC terminal the system manager adds to the VMS TERMTABLE definitions file is fully supported by all ***MultiNet*** utilities, including the TELNET and RLOGIN TERMINAL TYPE negotiations.

DECNET INTEROPERABILITY SERVICES

In addition to sharing a DEC Ethernet controller side-by-side with DECnet, ***MultiNet*** allows layering of the IP and DECnet protocol stacks.

DECnet-over-IP allows the system manager to use the DECnet Circuit Configuration Utility to configure a point-to-point DECnet circuit between any two ***MultiNet*** machines across an arbitrary IP network. This feature is ideal for providing DECnet connectivity across an IP-based LAN or WAN, especially when the alternative is to build the entire network with dual-protocol routers or duplicate communications hardware. Once the DECnet circuit between two ***MultiNet*** machines is established, any DECnet machine can use it.

IP-over-DECnet allows the system manager to use the Network Configuration Utility to configure a point-to-point IP connection between any two ***MultiNet*** machines across an arbitrary DECnet network. Like DECnet-over-IP, this feature can provide IP connectivity where DECnet connectivity already exists.

PROGRAMMING LIBRARIES

MultiNet includes a $QIO interface that offers the VMS programmer full access to the asynchronous I/O features of VAX/VMS. For compatibility with applications developed for 4.3BSD UNIX, ***MultiNet*** also provides a shareable 4.3BSD-compatible socket library and an RPC library based on Sun's public domain RPC. These libraries are also used by programmers who do not require all of the asynchronous I/O features of $QIO.

Extensive online help (under HELP MULTINET PROGRAMMING) is available documenting the features and calling sequences of the $QIO interface and the 4.3BSD-compatible socket calls. For compatibility with applications developed for Excelan's EXOS product line, an EXOS-compatible $QIO interface is provided. For compatibility with applications developed to run over DEC's VMS/ULTRIX Connection (UCX) package, a UCX-compatible $QIO interface is provided.

DOCUMENTATION

MultiNet documentation includes:

- *Release Notes*
- *Introduction to MultiNet*
- *MultiNet Installation Guide*
- *MultiNet Users' Guide*
- *MultiNet System Administrators' Guide*
- *MultiNet Programmers' Reference Manual*
- *MultiNet NFS Server System Administrators' Guide*
- *MultiNet NFS Client System Administrators' Guide*

SUPPORT

MultiNet support services include hotline service, updates, and remote diagnosis. The first 90 days of support are included in the product warranty. An annual maintenance agreement may be purchased to extend the support period.

PREREQUISITE SOFTWARE

VAX/VMS V4.5 or later

OPTIONAL SOFTWARE

NFS/PCNFSD Server for ***MultiNet***
NFS Client for ***MultiNet***

LICENSING

MultiNet is available under license from TGV, Incorporated, or a TGV-licensed OEM or distributor. For pricing and licensing information, contact your authorized ***MultiNet*** distributor or TGV, Inc. at 603 Mission Street, Santa Cruz, CA 95060; call TGV at (408) 427-4366 or (800) TGV-3440; or by FAX at (408) 427-4365.

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FEBRUARY 19, 1990

digital review

THE INDEPENDENT NEWSPAPER & TEST LAB OF DEC COMPUTIN

TGV premieres first NFS client software for VAX/VMS systems

By Steven Kovsky

SANTA CRUZ, Calif. — The first software that permits VAX machines running VMS to connect as clients to Unix servers running NFS will become available next month from TGV.

NFS Client for VMS represents a breakthrough for VMS users who have been shut out from sharing files with Unix-based file servers that run NFS (Network File System), Sun Microsystems' file directory system, which has become a de facto standard in the industry, according to David Kashtan, inventor of NFS Client for VMS.

The NFS client software for VMS will give VAX users access to both Unix servers and VMS servers for the first time.

Kashtan and Kenneth Adelman, formerly software developers at SRI International of Menlo Park, Calif., founded TGV (Two Guys and a VAX) in 1988.

While still at SRI, Kashtan developed Eunice, "the first true Unix emulation for VMS," Kashtan said.

The Eunice project was followed by Kashtan's development of what TGV officials claim is the first TCP/IP-compatible networking software for VMS. This latter SRI product, called MultiNet, became TGV's first offering shortly after the company was formed, Kashtan said.

The initial release of the NFS Client for VMS offering will require that MultiNet, which puts TCP/IP networking protocols on VMS, reside on the VAX.

According to TGV's Kashtan, NFS Client for VMS is based on a carefully crafted "pseudodriver" that emulates VMS' extended queued I/O, ancillary control process (XQP/ACP), which allows files on the NFS server to appear to the VAX user like the contents of a locally installed DEC disk drive.

The NFS client software transparently converts the semantics of the VMS file system directly to NFS-compatible calls, Kashtan said.

The process of matching VMS clients with NFS hosts has proved so complex that Kashtan doesn't believe any competitor is close to providing a similar software product.

"It's not a situation where we have a two- or three-month lead before someone else releases a competitive product," Kashtan said. "The degree of difficulty is such that others who have tried [to develop it] have given up."

NFS Client for VMS will be priced at about $500 for VAXstations, and could be higher for other VMS computers, officials said. MultiNet for VAXstations or VAXservers is priced at $1,200.

Kashtan said the initial version of NFS Client for VMS will support file and record locking only to the extent that RMS does. The software will not allow a VMS client to connect to a VMS host via NFS, he said.

Full record locking to come

Full record locking and access to VMS hosts via NFS are expected in the next release, Kashtan said.

As an optional adjunct to MultiNet, TGV markets NFS Server, which lets NFS clients access VMS-based file servers.

TGV has also announced a trade-in program for MultiNet. Customers can receive a credit of as much as 50 percent toward the purchase of MultiNet in exchange for any other board-based or host-based TCP/IP implementation for VMS, said Paul Rasmussen, TGV's general manager.

Prices for MultiNet range from $1,200 for VAXstations to $24,000 for the VAX 9000 Model 210.

For additional information, TGV Inc. can be contacted at 605 Mission St., Santa Cruz, CA 95060, (408) 427-4366.

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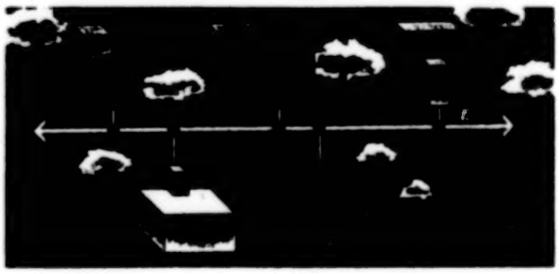

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TGV, Inc. [illegible] Santa Cruz, CA [illegible] Tel [illegible] FAX [illegible] ©1990 TGV, Inc.

MultiNet

The Multi-protocol Networking Environment

Overview

MultiNet is a high-performance VAX/VMS multi-protocol networking environment. This environment enables the interconnection of VAX/VMS computers to other systems operating the TCP/IP, CHAOSnet, or Xerox PUP protocol suites. ***MultiNet*** supports the entire family of TCP/IP (Transmission Control Protocol/Internet Protocol) services.

MultiNet utilizes state-of-the-art network technology—4.3BSD networking software running in the VAX/VMS kernel environment, communicating directly with the user process via a $QIO interface, and directly with VMS device drivers at the kernel level. ***MultiNet*** delivers maximum application-to-application performance through its implementation of light-weight process threads in the network kernel.

Installation and configuration of ***MultiNet*** has been designed to be simple and straightforward for both the experienced and the novice system manager:

- ***MultiNet*** contains all the tools for any configuration from an end-node system to a fully functional gateway with multiple interfaces and routing protocols.
- ***MultiNet*** installs quickly with the VAX/VMS VMSINSTAL utility.
- ***MultiNet*** configures easily to your network environment and generates all configuration files and the startup command procedure.
- ***MultiNet*** allows the system manager to examine the state of the network, and examine and modify the configuration without rebooting.
- ***MultiNet*** includes VMS-style interfaces with DCL commands, VMS HELP library entries, and clear, logical prompts for all applications and configuration management utilities.

Services

MultiNet's Master Server process is responsible for performing or invoking services for inbound connections. Many services normally performed in separate processes (e.g., BIND, GATED, SNMP) under other implementations are performed quickly and efficiently by the Master Server itself. Using the ***MultiNet*** Server Configuration Utility, the system manager can enable, disable, and add new services. The Master Server can also restrict IP host and network access; keep an audit trail of all connections; and log times, name and addresses, and services requested—all on a per-service basis. ***MultiNet*** services include the following and are all standard to the product:

- **Domain Name System**

  MultiNet includes version 4.8.1 of the Berkeley Internet Name Daemon (BIND) to provide Domain Name System (DNS) support. The ***MultiNet*** NSLOOKUP utility facilitates system tracking and debugging configuration problems.

- **TELNET**

  The TELNET network virtual terminal utility provides transparent access between your machine and any other node on the IP network. ***MultiNet*** has no architectural limit on the number of incoming TELNET sessions, and only requires approximately 500 bytes of memory per connection, making ***MultiNet*** ideally suited for terminal-server applications with hundreds of incoming sessions per machine. ***MultiNet's*** TELNET client supports the TN3270 protocol, allowing VMS users to access IBM mainframes as a 3270 block mode terminal.

- **DECwindows**

  MultiNet's DECwindows support provides users the ability to run DECwindows applications over TCP/IP in addition to DECnet.

- **FTP**

  The File Transfer Protocol utility transfers files between computers on an IP network. ***MultiNet*** supports two noteworthy extensions to the standard File Transfer Protocol specification: automatic negotiation of a mode providing efficient transparent transfer of any FILES-11 file (e.g., ISAM-indexed files) between VMS systems, and the use of Lempel-Ziv data compression, which can reduce network traffic and effectively increase the speed of slow lines by 30-100% (typically 60%). The ***MultiNet*** FTP Server uses the standard VMS LOGINOUT utility for account validation and setup, thus fully supporting all related VMS security features.

- **SMTP**

  The Simple Mail Transfer Protocol allows users to send and receive electronic mail over an IP network. Access to the ***MultiNet*** mail system is provided by both the standard VMS MAIL utility and the MM mail user interface.

- **MM**

  The MM utility provides an alternative to VMS MAIL for electronic mail users. MM offers several useful features not available under VMS MAIL including: the ability to save and restore messages before sending them, the ability to create user-defined headers, and a sophisticated message filing and manipulation scheme. MM can be used to send both SMTP and DECnet mail. Additionally, the MM utility can be used to send mail via the PMDF electronic mail gateway system available from Innosoft International, Inc.

- **LPR/LPD**

  The LPD protocol client and server allows ***MultiNet*** users to access printers on remote UNIX computers and vice versa. The LPD server makes VMS printer queues appear to remote UNIX users as local printers. The LPD client runs as a VMS print symbiont using the native VMS PRINT command to print files.

- **BSD "r" Services**

  MultiNet includes the popular UNIX "r" services RSHELL, REXEC, RCP, RLOGIN, and RMT.

- **TALK**

  The ***MultiNet*** TALK utility is a VMS PHONE-like utility which allows users to conduct on-line, interactive conversations with other users. Like VMS PHONE, TALK provides a split-window screen, with one window displaying text one user types, and the second displaying text the respondent types. For maximum interoperability, both the 4.2BSD "Old Talk" and 4.3BSD "New Talk" protocols are supported.

- **GATED**

  MultiNet provides support for the EGP (RFC911), RIP (RFC-1058), and HELLO routing protocols, using GATED Version 1.9.

- **SNMP**

  A Simple Network Management Protocol agent is included in ***MultiNet***, allowing network managers to query such information as interface status, protocol statistics, and routing information.

- **DECnet Protocol Layering**

  In addition to sharing a DEC Ethernet controller side-by-side with DECnet, ***MultiNet*** allows layering of the IP and DECnet protocol stacks. DECnet-over-IP allows the system manager to configure a point-to-point DECnet circuit between any two ***MultiNet*** machines across an arbitrary IP network. IP-over-DECnet allows the system manager to configure a point-to-point IP connection between any two ***MultiNet*** machines across an arbitrary DECnet network. These features are ideal for expanding connectivity to include both protocol families across a connection which only supports one protocol family.

Diagnostic Tools

The ***MultiNet*** PING, TRACEROUTE, and TCPDUMP utilities turn every VAX on your network into a network analyzer. PING measures the quality of a network connection. TRACEROUTE is used to trace the path of an IP datagram through your network to a specified destination. TCPDUMP is used to debug LAN problems by capturing, formatting, and displaying Ethernet datagrams.

Custom Applications

MultiNet includes a 4.3BSD-compatible socket library as well as a $QIO interface which allows users to develop custom applications.

Software Requirements

VAX/VMS V4.5 or greater. Uses spinlock synchronization to support Symmetrical Multi-Processing (SMP) under VMS version V5.

Supported Configurations

Digital Equipment Corporation's VAX and MicroVAX computers in any valid VMS configuration.

Supported Network Interfaces

Ethernet Interfaces

- All DEC Ethernet controllers currently supported by DEC, multiplexing features enable sharing with other protocols—DECnet, LAT, and Local Area VAXclustering
- CMC's ENP family of Ethernet controllers
- Excelan's EXOS UNIBUS and Q-bus controllers
- Interlan's NI1010 Ethernet controller
- 3-Com's Ethernet controller
- Xerox's 3-Megabit Ethernet controller

DDN/ARPAnet Interfaces

- ACC's LH-DH ARPAnet controller
- ACC's ACP-5250 and ACP-6250 X.25 controllers (may be used to connect systems to the Defense Data Network PSNs)
- IMP11-A ARPAnet controller

WAN Interfaces

- ACC's ACP-5100 and ACP-6100 HDLC T1 controllers
- DEC's DMR-11, DMC-11, and DMV-11 DDCMP
- SLIP (Serial Line IP) using any VMS-supported terminal multiplexer

Other LAN Interfaces

- Proteon's proNET-10 and proNET-80 Token-Ring controller
- NSC's PI13/14 Hyperchannel controller
- Symbolics' CHAOSnet 4-Megabit controller

Optional Software

NFS Client for ***MultiNet***
NFS Server for ***MultiNet*** (includes support for PC-NFS)

Product Packaging

MultiNet is distributed on a 1600 BPI magnetic tape or TK50 streaming cassette tape. Included with ***MultiNet*** software are the manuals, *Introduction to MultiNet*, *MultiNet Installation Guide*, *MultiNet System Administrators' Guide*, *MultiNet Users' Guide*, *MultiNet Programmers' Reference Manual*, and optionally the *MultiNet NFS Server System Administrators' Guide* and *MultiNet NFS Client System Administrators' Guide*.

Product Support

Product support is provided for ninety (90) days with ***MultiNet*** which includes new releases, documentation, telephone consultation, and remote diagnosis. Support can be extended to an annual basis with a software maintenance agreement. Contact TGV, Inc. for further information.

TGV, Incorporated
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Q3-90 Version V2.2 Rev 1

MultiNet NFS Client & NFS Server for VMS

Overview

MultiNet is the first VAX/VMS networking environment to offer both ***NFS Client*** and ***NFS Server*** for VMS. These features enable the complete interconnection of VAX/VMS systems to any other system which supports NFS.

NFS Client

The ***MultiNet NFS Client*** allows VMS applications to transparently access files stored on NFS servers. The ***NFS Client*** can remote mount file systems on ANY system having an NFS server. The ***NFS Client*** device driver provides a standard file system interface and is called automatically by the normal VMS Record Management Services (RMS).

Remote NFS servers supporting full UNIX (NFS) file system semantics appear to VAX/VMS systems as fully-functional Files-11 ODS-2 file systems. This includes support for multiple file versions and arbitrary VMS (RMS) file attributes. Files created on the server system appear as Stream_LF files to the local VAX/VMS system. Text files created by the local VAX/VMS system appear as normal "Stream" files on the server and can, therefore, be shared with applications running on the NFS server and other (including NON-VMS) NFS clients. Other VAX/VMS file types are stored on the NFS server as "raw" VMS data blocks (as produced on the VMS system) plus information about the VMS (RMS) file attributes. This permits other VAX/VMS clients to share these files on the NFS server and non-VMS systems to access the data, provided the non-VMS systems are capable of interpreting the "raw" VMS data blocks.

On systems not supporting full UNIX (NFS) file system semantics, the local VAX/VMS system sees a restricted file system, which does not support multiple file versions or arbitrary VMS (RMS) file attributes. All remote files appear as VAX/VMS Stream_LF files, which permits the sharing of text files between systems.

NFS Server

The ***MultiNet NFS Server*** is a high-performance kernel implementation of NFS for VMS. The ***NFS Server*** maps the complete UNIX file system semantics onto the VMS file system, including symbolic and hard links and device files, making a VMS file system look exactly like a UNIX file system. When accessed from an ***NFS Client***, all VMS text files are type-converted to look like UNIX stream files for maximum interoperability. The ***NFS Server*** uses a file and directory cache between the file system and the network, to mask VMS bottlenecks from the requesting UNIX machine. The ***NFS Server*** uses a proprietary XDR serializer to move data directly between the file system cache and the network buffers. By default, the cache functions as a write-through cache, but can be configured as a write-back cache to increase performance.

The ***NFS Server*** can export all Files-11 ODS-2 VMS volumes, including shadow sets, bound volumes, and DFS-served disks.

The ***NFS Server*** distribution also includes a PC-NFS authentication and print server (PCNFSD). It allows IBM PCs and compatibles running NFS client software to access NFS served filesystems as though they are local DOS disk drives. PCNFSD supports printing from PC clients to VMS print queues.

Software Requirements

MultiNet V2.2 or greater and VAX/VMS V4.5 or greater. Uses spinlock synchronization to support Symmetrical Multi-Processing (SMP) under VMS version V5.

Supported Configurations

Digital Equipment Corporation's VAX and MicroVAX computers in any valid VMS and ***MultiNet*** configuration.

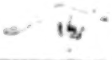
Product Packaging

MultiNet NFS Client and the ***MultiNet NFS Server*** are distributed on a 1600 BPI magnetic tape or TK50 streaming cassette tape as part of the normal ***MultiNet*** distribution. No separate installation is required.

Included with the software are the *MultiNet NFS Server Administrators' Guide* and the *MultiNet NFS Client Administrators' Guide*.

Product Support

Product support is provided for ninety (90) days with ***MultiNet*** which includes new releases, documentation, telephone consultation, and remote diagnosis. Support can be extended to an annual basis with a software maintenance agreement. Contact TGV, Inc. for further information.



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Q3-90 Version V2.2 Rev 1

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E. NSI Network Operations Center

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NSI Operations Center

Nancy L. Zanley, Network Operations Analyst
Sterling Federal Systems, Inc.

The NASA Science Internet (NSI) Network Operations Staff is responsible for providing reliable communication connectivity for the NASA science community. As the NSI user community expands, so does the demand for greater interoperability with users and resources on other networks (e.g., NSFnet, ESnet), both nationally and internationally.

Coupled with the science community's demand for greater access to other resources is the demand for more reliable communication connectivity. Recognizing this, the NASA Science Internet Project Office (NSIPO) expanded its Operations activities. By January 1990, Network Operations was equipped with a telephone hotline, and its staff was expanded to six Network Operations Analysts. These six analysts provide 24-hour-a-day, 7-day-a-week coverage to assist site managers with problem determination and resolution.

The NSI Operations staff monitors network circuits and their associated routers. In most instances, NSI Operations diagnoses and reports problems before users realize a problem exists.

Monitoring of the NSI TCP/IP Network is currently being done with Proteon's Overview monitoring system (see photo). The Overview monitoring system displays a map of the NSI network utilizing various colors to indicate the conditions of the components being monitored. Each node or site is polled via the Simple Network Monitoring Protocol (SNMP). If a circuit goes down, Overview alerts the Network Operations staff with an audible alarm and changes the color of the component. When an alert is received, Network Operations personnel immediately:

a) Verify and diagnose the problem
b) Coordinate repair with other networking service groups
c) Track problems, and
d) Document problem and resolution into a trouble ticket data base.

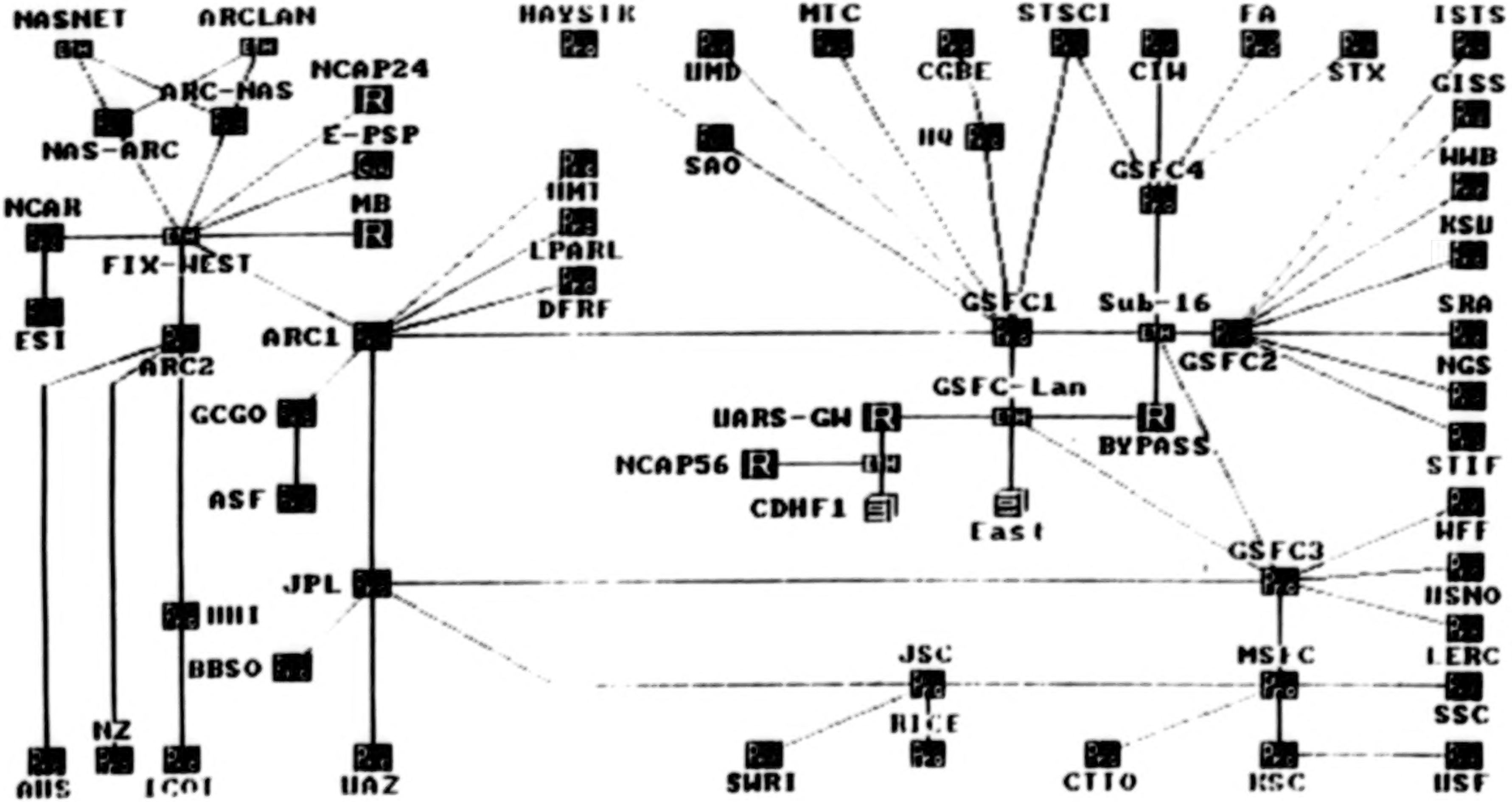
NSI Operations offers the NSI science community reliable connectivity by exercising prompt assessment and resolution of network problems.

NSI Site Acronym List

ARC1	Ames Research Center, Moffett Field, CA (router #1)
ARC2	Ames Research Center, Moffett Field, CA (router #2)
ASF	Alaska SAR Facility/University of Alaska Geophysical Institute
AUS	Australian Academic Research Network
BBSO	Big Bear Solar Observatory, Big Bear City, CA
CGBE	Capital Gallery Building, East Wing, Washington, D.C.
CIW	Carnegie Institution of Washington, Washington, D.C.
CTIO	Cerro Tololo Inter-American Observatory, Chile
DFRF	Ames-Dryden Flight Research Facility, Edwards AFB, CA
E-PSP	Exterior-Packet Switching Processor Gateway to NSFNET
EAST	Interoperability Gateway
ESI	Astrophysics Data System, Ellery Systems Inc., Boulder, CO
FA	Ford Aerospace, ST DADS Program, Seabrook, MD
GCGO	Gilmore Creek Geophysical Observatory, Alaska
GISS	Goddard Institute for Space Studies, New York, NY
GSFC1	Goddard Space Flight Center, Greenbelt, MD (router #1)
GSFC2	Goddard Space Flight Center, Greenbelt, MD (router #2)
GSFC3	Goddard Space Flight Center, Greenbelt, MD (router #3)
GSFC4	Goddard Space Flight Center, Greenbelt, MD (router #4)
HAYSTK	Haystack Observatory, Westford, MA
HQ	NASA Headquarters, Washington, D.C.
ICOT	Institute for New Generation Computer Technology, Japan
ISTS	Institute for Space and Terrestrial Science, York University, Ontario, Canada
JPL	Jet Propulsion Laboratory, Pasadena, CA
JSC	Johnson Space Center, Houston, TX
KSC	Kennedy Space Center, Cape Canaveral, FL
KSU	Kansas State University, Manhattan, KS
LERC	Lewis Research Center, Cleveland, OH
LPARL	Lockheed Palo Alto Research Laboratory, Palo Alto, CA
MB	BBN Mailbridge to MILNET

MSFC	Marshall Space Flight Center, Huntsville, AL
MTC	Solar Max Mission, Maryland Trade Center, MD
NCAP24	Encapsulation for AREA 24, ARC, Moffett Field, CA
NCAP56	Encapsulation for AREA 56, UARS Project, GSFC, Greenbelt, MD
NCAR	National Center for Atmospheric Research, Boulder, CO
NGS	National Geodetic Survey, Rockville, MD
NZ	University of Waikato, New Zealand
RICE	Sesquinet, Rice University, Houston,TX
SAO	Smithsonian Astrophysical Observatory, Cambridge, MA
SRA	Science Research Associates, Glastonbury, CT
SSC	Stennis Space Center, MS
STIF	NASA Scientific and Technical Information Facility, Linthicum, MD
STSCI	Space Telescope Science Institute, Baltimore, MD
STX	ST Systems Corp, Lanham, MD
SWRI	Southwest Research Institute, San Antonio, TX
UAZ	University of Arizona, Tucson, AZ
UHI	University of Hawaii, Honolulu, HI
UMD	SURAnet, University of Maryland, College Park, MD
UMT	University of Montana, Missoula, MT
USF	University of South Florida, St. Petersburg, FL
USNO	United States Naval Observatory, Washington, D.C.
WFF	Wallops Flight Facility, Wallops Island, VA
WWB	National Oceanographic and Atmospheric Administration, World Weather Building, Camp Springs, MD

NASA SCIENCE INTERNET WIDE AREA NETWORK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RICE
NZ
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UAZ
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CTIO
KSC
USF

NSI NOC's most frequently asked questions.

Q. What does NSI NOC mean?

A. NASA Science Internets' Network Operations Center.

Q. What does NSI NOC do?

A. The NSI network operations staff monitors the NASA Science Internet.

Q. Does NSI NOC perform other duties besides monitoring the NASA Science Internet?

A. Yes, we are also site contacts for other NOCs.

NOC Questions, continued

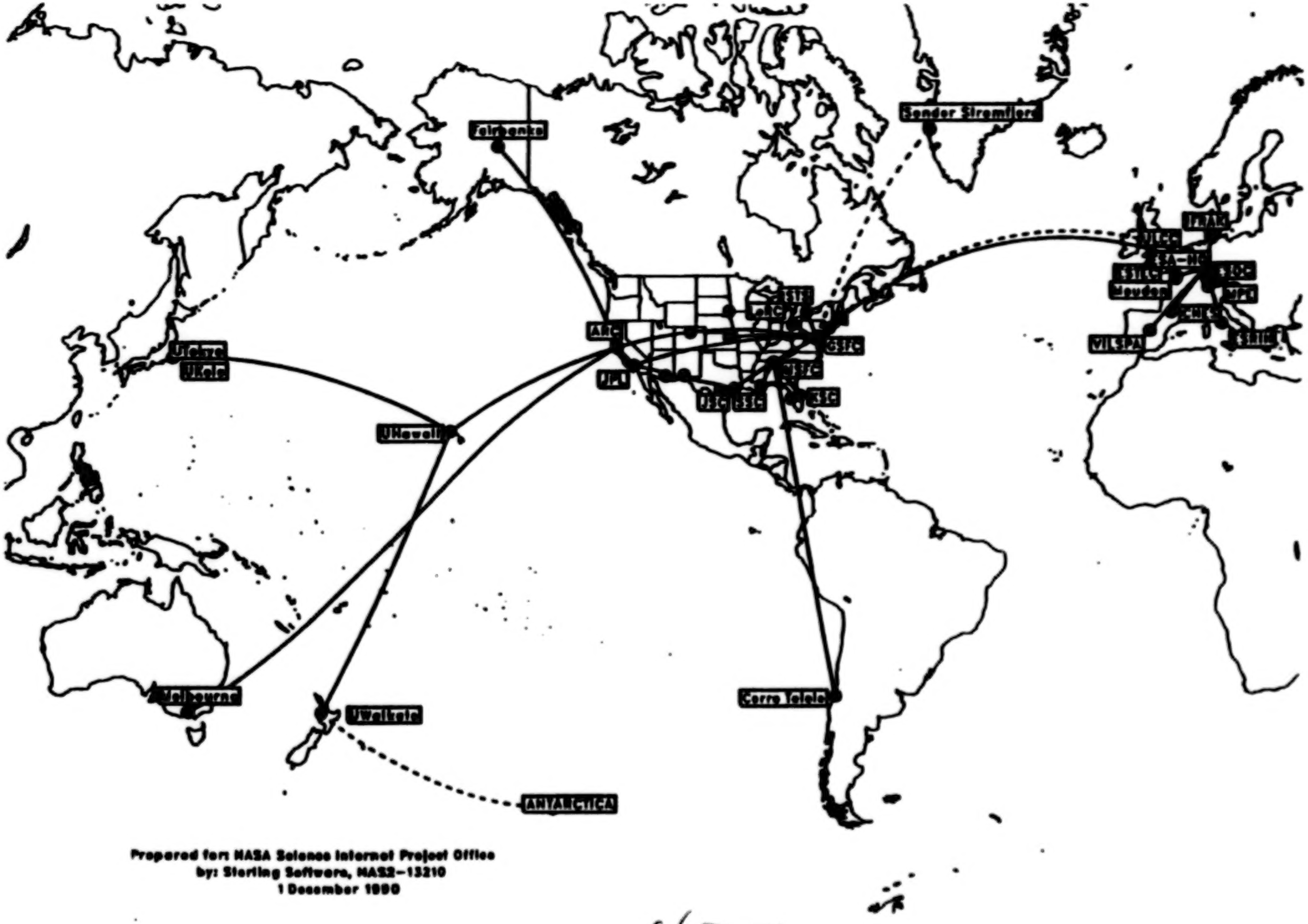
Q. What hours during the day can NSI NOC be reached?

A. 24 hours a day, 7 days a week.

Q. Who do I contact when I'm experiencing networking problems?

A. If you are unable to solve problem through your local site manager, call NSI NOC directly at 415 604-3655.

NASA Science Internet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UKoio
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MSFC
KSC
GSFC
Cerro Tololo
ULCC
ESA-HQ
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ESOC
MPE
CNES
ESRIN
VILSPA

Prepared for: NASA Science Internet Project Office
by: Sterling Software, NAS2-13210
1 December 1990

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F. NSI White Pages Project

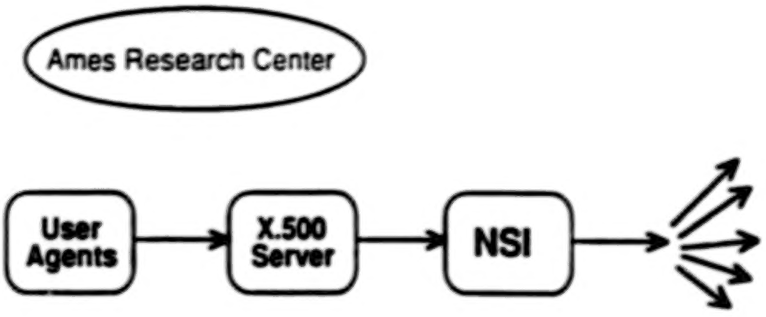
X.500
Directory Service

John Yin

February 1991

What is X.500?

- An international standard for a globally distributed directory.
- Provides basic addressing information.
- Provides detailed information on countries, organizations, people, and resources (e.g., where printers are).
- Present pilot project able to access information in 14 countries.

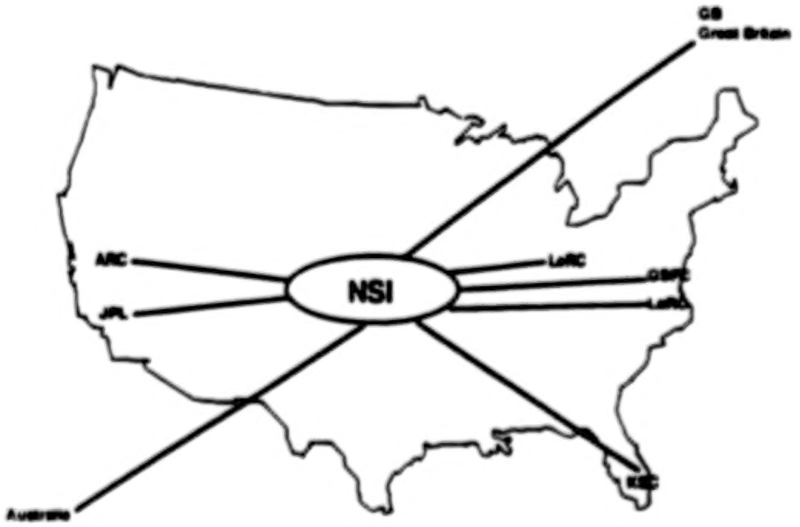

Ames Research Center

User Agents → X.500 Server → NSI →

X.500 defines:

- The interaction between user agents and a server.
- The interaction between servers over a wide area network.

NASA Ames Research Center
Moffett Field, CA 94035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Great Britain
ARC
JPL
NSI
LeRC
GSFC
LaRC
KSC
Australia

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Advantages of X.500

- The first standardized inter-organization directory service.
- Fast becoming a world-wide standard. Pilot project in use in 14 countries.
- The only way to access extensive, distributed, global information. Other services presently available offer only limited information.

User Agents / Interfaces Available

Pod	Uses the X-windows system. Simple point and click interface makes it user friendly. Accessible to novice users.
Sd (Screen Directory)	Screen oriented interface with the same functionality as Pod.
Dish	A powerful tool enabling advanced users to access extensive information and customize their queries.
Fred (FRont-End to Dish)	Uses a command line. Specializes in email and other addressing information. A user friendly front-end to dish.
Xwp (White Pages interface for X.500 Systems)	X-windows interface that supports user friendly naming.

Immediate Goals

- Provide an operational X.500 backbone for NASA Science Network users.
- Integrate non-Unix based User Agents.
  Macintosh, PC, VAX/VMS, IBM Profs.
- Establish X.500 access points and provide access control lists where appropriate.

Future Goals

- A GOSIP requirement.
- **Access more vital and detailed information.**
  X.500 users will be able to access information on application processes, entities, and devices.
- Integrate with non-Science Network X.500 directory servers.

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G. NSI Customer Service Representatives and User Support Office

National Aeronautics and
Space Administration

Ames Research Center

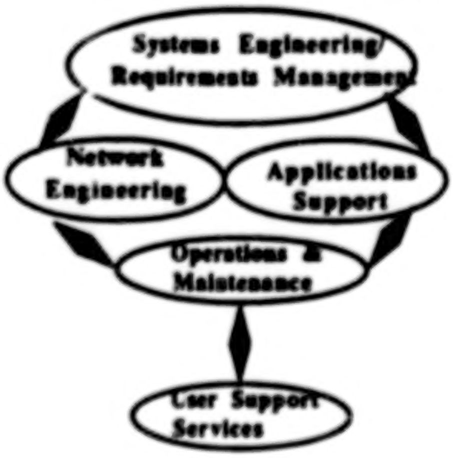
NASA Science Internet

What is the NASA Science Internet?

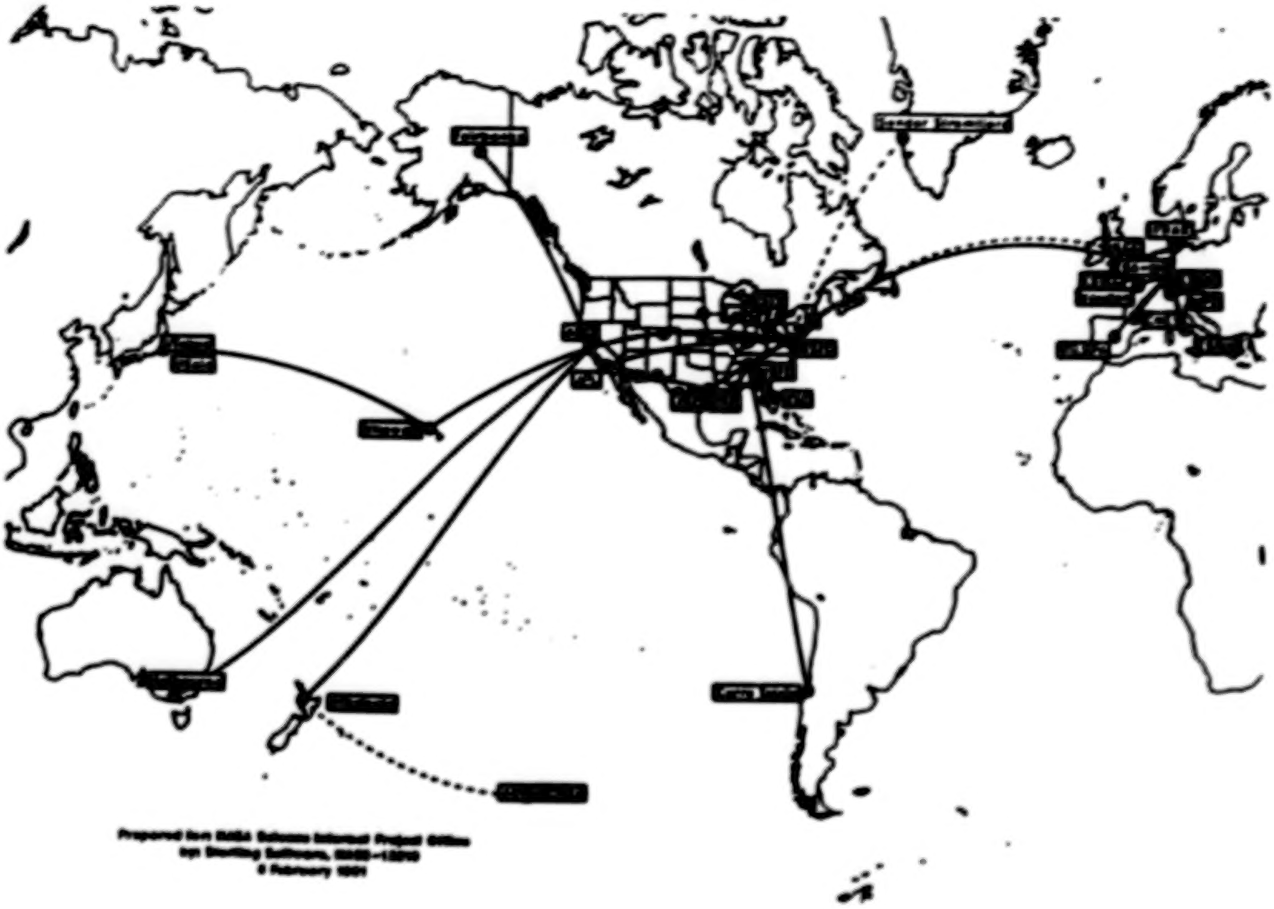
The NASA Science Internet, NSI, was established in 1987 to provide NASA's Office of Space Science and Applications (OSSA) missions with transparent wide-area data connectivity to NASA's researchers, computational resources, and databases.

The NSI Office at NASA/Ames Research Center has the lead responsibility for implementing a total, open networking program to serve the OSSA community. NSI is a full-service communications provider whose services include science network planning, network engineering, applications development, network operations, and network information center/user support services.

NSI Network Services


Systems Engineering/
Requirements Management
Network
Engineering
Applications
Support
Operations &
Maintenance
User Support
Services

NASA Science Internet



Prepared for NASA Science Internet Project Office
by Sterling Software, [illegible]
6 February 1991

What is NSI's Mission?

NSI's mission is to provide reliable high-speed communications to the NASA science community. To this end, the NSI Office manages and operates the NASA Science Internet, a multiprotocol network currently supporting both DECnet and TCP/IP protocols. NSI utilizes state-of-the-art network technology to meet its customers' requirements.

The NASA Science Internet interconnects with other national networks including the National Science Foundation's NSFNET, the Department of Energy's ESnet, and the Department of Defense's MILNET. NSI also has international connections to Japan, Australia, New Zealand, Chile, and several European countries.

NSI cooperates with other government agencies as well as academic and commercial organizations to implement networking technologies which foster interoperability, improve reliability and performance, increase security and control, and expedite migration to the OSI protocols.

NSI will be a major participant in the establishment of a high-speed National Research and Education Network (NREN).

NSI provides an open, secure, shared network to assure the success of its users' missions by:

- supporting geographically distributed users
- accommodating advanced applications
- providing reliable and robust access to remote facilities
- integrating users into the overall network environment, and
- supporting high-performance access to the science community

Who does NSI support?

NSI supports the NASA Science community which consists of more than 12,000 Office of Space Science & Applications (OSSA) scientists, researchers, engineers, and administrators around the world.

NSI's circuits are provided primarily by PSCN. It also utilizes other national or international science networking providers.

NSI's personnel is noted worldwide for its networking expertise, and its highly modern operation and control center facilities assure leading-edge technology in network monitoring and problem control.

What are NSI's Service Levels ?

NSI's *basic* service provides an open, secure, shared network to assure mission success. This service includes connectivity for file transfer, electronic mail, and remote logon. Basic service supports both TCP/IP and DECnet, and includes open connectivity within the United States as well as with international NASA collaborators. Basic Service is provided at no charge to authorized users by OSSA's Communications and Information Systems Division.

Custom service includes high-speed dedicated lines in addition to the basic services. Custom service requirements are engineered and costed on a case-by-case basis.

How do customers connect with NSI?

Customers contact the appropriate NSI Office Customer Service Representative (see back page for details) to describe their requirements. The NSI Office then obtains program authorization and relevant accounting information. When that is complete, NSI implements the required service and monitors performance.

Customer Service Representatives provide continual feedback on the status of the customer's request during this process. After implementation, the Network Information Center, located at the Goddard Space Flight Center, will provide information about all aspects of the NSI program, such as mail, specialized applications, data bases, and white and yellow pages.

What does NSI support include?

- **Requirements management** which includes documentation, tracking, and reporting from initiation through service implementation.
- **Real-time, off-line help** on network- and service-related questions, and appropriate referral to Network Operations Centers (NOCs) and Network Information Centers (NICs).
- **A 24-hour/7-day Network Operations Center** (NOC) which monitors network traffic and assures network reliability, performance, and speed.
- **User services**
  - o Network Information Center
  - o Conference support
  - o Documentation and tutorials
  - o User groups
- **Security coordination** provides an audit–trail of network activity and information on security incidents and intrusions.

For more information

Customer Service
NASA Science Internet
NASA Ames Research Center
Mail Stop: 233-8
Moffett Field, CA 94035-1000
U.S.A.

Telephone:	**Facsimile:**	**E-mail Address:**
Domestic:		
1-415-604-5859	**415-604-0063**	IP: nsi-nic@nsipo.nasa.gov
FTS: 464-5859	FTS: 464-0063	DECnet: ames::"nsi-nic@nsipo.nasa.gov" 24810::"nsi-nic@nsipo.nasa.gov"
International:		NASAMAIL:NSINIC
01-415-604-5859		

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035-1000

The NASA Science Internet - An Integrated Approach to Networking

by Fred Rounds, NSI Project Manager

An integrated approach to building a networking infrastructure is an absolute necessity for meeting the multidisciplinary science networking requirements of the OSSA science community. These networking requirements include communications connectivity between computational resources, databases, and library systems, as well as to other scientists and researchers around the world.

A consolidated networking approach allows strategic use of the existing science networking within the federal government, and it provides networking capability that takes into consideration national and international trends towards multivendor and multiprotocol service. It also offers a practical vehicle for optimizing costs and maximizing performance. Finally, and perhaps most important to the development of high-speed computing, is that an integrated network constitutes a focus for phasing to the National Research and Education Network (NREN).

The NASA Science Internet (NSI) program, established in mid 1988, is structured to provide just such an integrated network. NSI coordinates and consolidates science user requirements for non-mission-critical computer networking. It further designs and implements its networks to provide the computer protocols and performances needed by the scientists. In the process of consolidating circuits, NSI uses multiprotocol and interprotocol networking technology and works to facilitate sharing of applications software and services. NSI also coordinates the integration of Code SC information systems as well as advanced applications, such as remote visualization, wide-band video, etc., into the network. Throughout its operations, NSI is responsible for providing efficient management of NASA data communications facilities and for assuring resource control and security.

The initial step in gaining connectivity to NSI is for potential users to contact NSI's Customer Service Representatives. The CSRs gather the user's requirements on Network Service Request forms; when such requests are validated by NASA Headquarters as OSSA-supported projects, the requirements are passed on to NSI Engineers who configure the network architecture, acquire and test the circuits, and bring the circuits into full connectivity with NSI.

NSI provides users with full support. NSI's Network Information Center at Goddard Space Flight Center plans to provide user support services in the form of White- and Yellow-Page Directory Services, a User Help Desk, and periodic NSI User Working Group meetings. The Network Operations Center at Ames Research Center monitors NSI networks 24 hours a day, 7 days a week. The Operations Center monitors and analyses network traffic, manages problems that arise, and handles equipment installation, upgrades, and maintenance.

The integrated networking approach provided by NSI significantly increases scientific collaboration. It improves access to large-scale scientific computing, data processing tools, mail facilities, and other federal and international networks, and it makes more rapid and efficient exchange of scientific data possible.

NSI2-91c

NSI Directed to Continue SPAN's Functions

Fred Rounds, NSI Project Manager

During a series of network management retreats in June and July of 1990, representatives from NASA Headquarters Codes O and S agreed on networking roles and responsibilities for their respective organizations. The representatives decided that NSI will assume management of both the Space Physics Analysis Network (SPAN) and the NASA Science Network (NSN). SPAN is now known as the NSI/DECnet, and NSN is now known as the NSI/IP. Some management functions will be distributed between ARC and GSFC. NSI at ARC has the lead role for requirements generation and network engineering. Pat Gary at GSFC will develop Advanced Applications and the Network Information Center. He will also lead NSI User Services, but NSI at Ames will continue to provide User Services during the transition. The transition will be made as transparent as possible for the users.

DECnet service will continue, but is now directly managed by NSI at Ames. NSI will continue to work closely with routing center managers at other NASA centers, and has formed a transition team to address the change in management. An NSI-DECnet working group has also been formed as a separate engineering group within NSI to plan the transition to Phase V, DECnet's approach to Open System Integration (OSI). Transition is not expected for a year or more due to delays in product releases. For further information and details, contact Warren VanCamp, 415-604-4796

Plans to upgrade speeds in tail circuits and the backbone are underway. The proposed baseline service for new connections is up to 56 Kbps; 9.6 Kbps lines will gradually be upgraded as requirements dictate. NSI is in the process of consolidating protocol traffic, tail circuits, and the backbone. Currently NSI's backbone is fractional T1; NSI will go to full T1 service as soon as it is feasible.

NSI Sponsors Open Forum at the American Geophysical Union Conference, Dec. 1990

Tom Armstrong introduced the first NSI Open Forum at the American Geophysical Union last December in San Francisco. Christine Falsetti chaired the session where users were encouraged to raise questions about specific issues concerning NSI. Fred Rounds, NSI Project Manager, and Warren Van Camp, NSI Engineer, were on hand to answer the questions. Some of those questions are highlighted below:

Question: How will 56 Kbps upgrades be handled?
Answer: All NSI circuits will be reviewed and a determination will be made of circuits appropriate for upgrade. A review will then be held with affected users, following which upgrades will begin. The proposed schedule for upgrades will be as follows: 15 circuits in FY 91, 20 circuits in FY 92, and 17 circuits in FY 93.

Question: Who can users call for networking services?
Answer: NSI staff is available to answer questions regarding establishing connections to NSI, change of service, resource availability, or network problems.

Network Information Center:	301-286-7251
Requirements Control Desk:	415-604-5859
24 x 7 Operations Desk:	415-604-3655

Question: How will organizational issues affect science projects such as ISTP and UARS?
Answer: 1) ARC will be the focus of the Network Operations Center, providing 24-hour-a-day, 7-day-a-week service.

2) NSI will design circuits to meet requirements using a wider range of tools, such as shared networks (NSF, DOE, DARPA), encapsulation, multiprotocol routers, and specialized dedicated circuits where needed.

3) The NSI backbone will be upgraded.

4) NSI will support DECnet, TCP/IP, and eventually OSI protocols.

5) NSI will participate in NREN as the technology emerges.

Question: What will the newly formed User Services Group be responsible for, and what is it planning to provide for the user communities?
Answer: The Network Information Center (NIC) effort will be led from Goddard Space Flight Center. The GSFC NIC plans to provide the following services: White/ Yellow Pages directory services; user help desk and hotline (in conjunction with the Network Operations Center at ARC): user information forums; NSI User Working Group coordination and logistics support; regional customer support; user security; information on security policies and plans; and "kits" and other security material which will be distributed to all users.

Question: What is the current status of security on the net? What is being done to upgrade the security toolkit?
Answer: Network security resides primarily with the host. This is an essential element of open networking. Other measures include continuous network monitoring and use of security-oriented tools.

NSI is preparing a Security Plan and Risk Analysis/Management Plan that incorporates both NSI-TCP/IP and NSI-DECnet network protocol security approaches. In addition, existing guidelines, tools, and reports are available to assist users in security matters. These materials are available for users from the NSI Security Group Leader, Ron Tencati, at FTS 888-5223, or 301-286-5223.

NSI2-91e

The NSI User Support Office (NSIUSO) Presents...

THE NASA SCIENCE INTERNET NETWORK INFORMATION CENTER (NSINIC) ON-LINE SYSTEM

NSINIC is a menu-driven help facility designed to aid both novice and experienced users of the NASA Science Internet. NSINIC includes user guides for general and inter-operating networking functions (e.g., remote logins and file transfers); listings of who to call for help at individual NASA centers; and general information about the NSI. Automated utilities within NSINIC provide transparent access to on-line help and other systems. Users are encouraged to access the NSINIC on-line system and leave comments.

Accessing NSINIC:

...from a TCP/IP System: TELNET to DFTNIC.gsfc.nasa.gov (128.183.10.3); username is NSINIC.

...from a DECnet System: SET HOST to DFTNIC (DECnet address is 6148); username is NSINIC.

...via Dial-Up Links: Dial the appropriate access number as shown in the following table (all are area code 301), then follow the instructions listed below:

Speed	Parity	Bit Settings	Telephone	Notes
300-2400	ODD/NONE	8 d/1 s or 7 d/2 s	286-9000	All these modems automatically set themselves for the correct speed.
300-2400	EVEN	7 data/1 stop	286-9500	
9600	NONE	8d/1s or 7d/2s	286-4000	Only 8 are available.
9600	EVEN	7 data/1 stop	286-4500	Only 4 are available.

System Prompt	You Type...	
CALL, DISPLAY, OR MODIFY?	CALL SISC <CR>	[NOTE: If dialing from off-GSFC, you will see "ENTER NUMBER" instead!
DIALING nnnnn		
CALL COMPLETE	<CR> <CR>	
Enter username>	(type your name here) <CR>	
(misc. system messages)		
Local>	C DFTNIC <CR>	
(misc. system messages)		
Username:	NSINIC <CR>	

...via SprintNet (X.25) Links: Dial your local SprintNet (formerly Telenet) access number, then hit [RETURN] or [ENTER] several times until you see the "@" prompt. (Information on local SprintNet access is available from the NSIUSO.) *NOTE: If you are dialing in to SprintNet, you will need a NASA Packet Switched System (NPSS) DACS userid; contact the NSIUSO for more information.*

System Prompt	You Type...
@	C NASA
"CONNECTION ESTABLISHED"	<CR> <CR>
(misc. system messages)	
*	LOGON <CR>
ENTER USERID>	(your DACS ID) <CR>
ENTER PASSWORD>	(your DACS p/w) <CR>
ENTER SERVICE>	DFTNIC <CR>
(misc. system messages)	
Username:	NSINIC <CR>

Questions and/or comments about the NSINIC may be e-mailed to the account name "NSIHELP" at any of the following:
DECnet: DFTNIC (6148) TCP/IP: dftnic.gsfc.nasa.gov (128.183.10.3) BITNET: dftbit

NASA Science Internet User Support Office
Advanced Data Flow Technology Office, Code 930.4
NASA Goddard Space Flight Center
Greenbelt, MD 20771
301-286-7251/9514 or FTS 888-7251/9514

NASA
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Meeting in San Mateo, California, February 11-14, 1991.
Lenore A. Jackson: ST Systems Corporation (STX), Lanham, Maryland.
J. Patrick Gary: Goddard Space Flight Center, Greenbelt, Maryland.

16. Abstract

This report contains copies of the agenda, list of attendees, meeting summaries, and all presentations and exhibit material of the NASA Science Internet User Working Group (NSIUWG) Conference held in San Mateo, California, on February 11-14, 1991. The conference included plenary sessions, exhibits of advanced networking applications, and user subgroup meetings on NASA Science Internet policy, networking, security, and user services and applications topics. The conference attracted over 115 scientists and data systems personnel from NASA, other U.S. Government agencies, universities, private research labs and industry, and other countries.

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